THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXX. No. 757.] LONDON, NOVEMBER 13, 1877. [29th Year.] Price 6d.

ESTABLISHED 1782.

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SILVER MEDAL, PARIS EXHIBITION, 1867.

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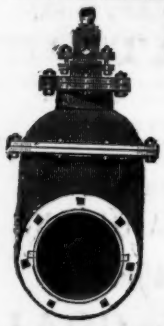
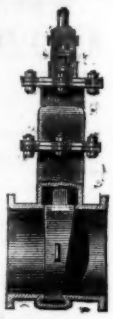


C. & W. WALKERS' DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves have taken the place of the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

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The front facing is vertical; the back facing forms the wedge.

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The Silber Tubulated Gas-Burner.

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The *Lancet* says: "Mr. Silber has obtained a light of singular steadiness, whiteness, and illuminating power, with the great additional advantage of such perfect combustion as to preserve the purity of the atmosphere."

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The Silber Tubulated Gas-Burner, with Opal Shade and Cup and Governor attached.

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The Times says: "Besides the Argand burners, some improved Bat's-wing burners of different sizes were exhibited. In these there is an internal chamber permitting the expansion of the gas before it reaches the flame. They are constructed to burn from two to eight cubic feet of gas per hour, and the illumination they give ranges from 4 to 30 candles, a considerable improvement upon any burners of the same kind that have hitherto been constructed."

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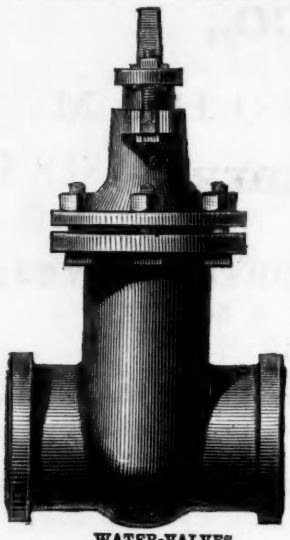

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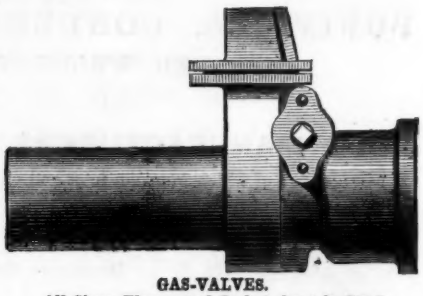

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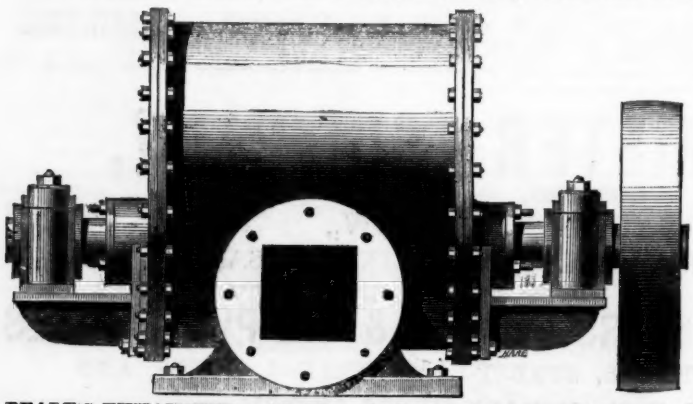

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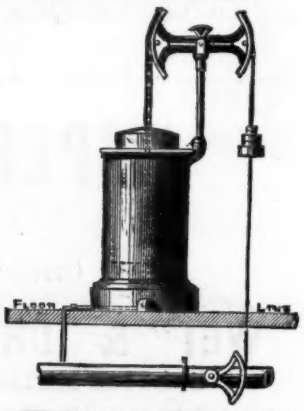
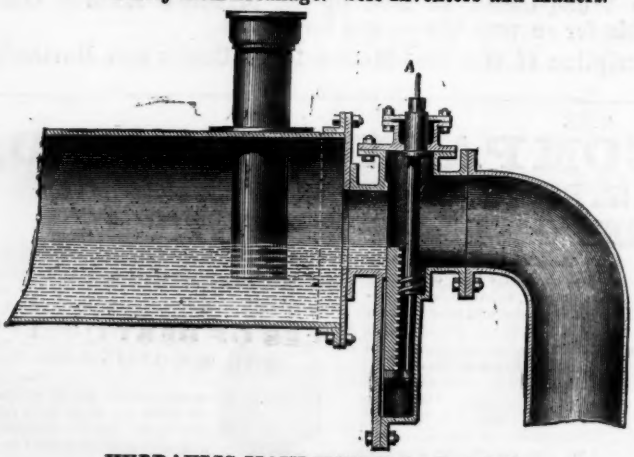
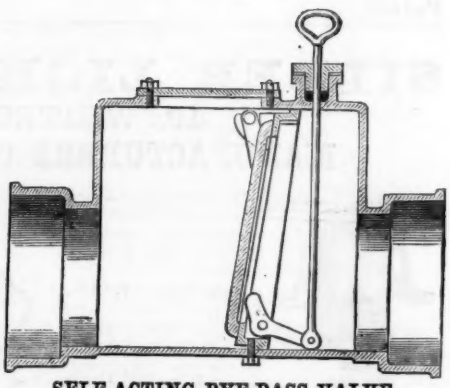


HYDRAULIC REGULATOR.



HYDRAULIC MAIN VALVE for Regulating Seal of Dip-Pipes.



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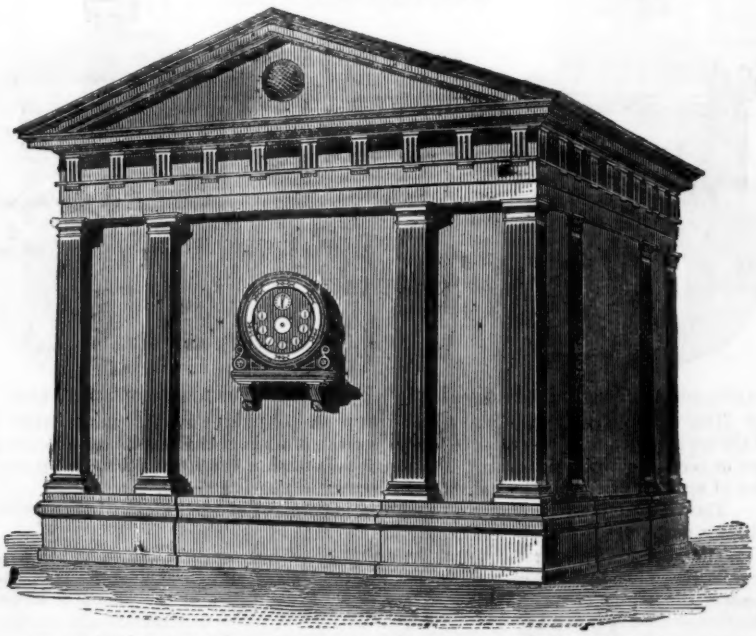

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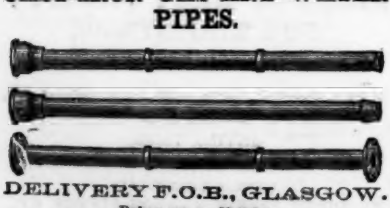
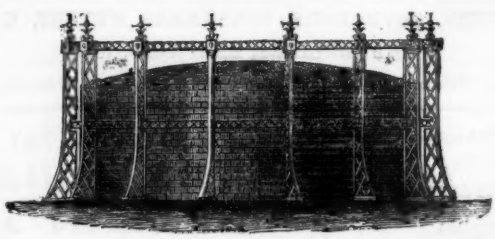
CAST-IRON GAS AND WATER PIPES.



DELIVERY F.O.B., GLASGOW.
Prices on application.

JOHN HALL AND CO., STOURBRIDGE,
Manufacturers of FIRE-BRICKS, LUMPS, TILES,

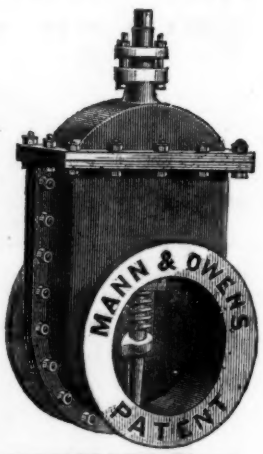
AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.
N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.



THE HORSELEY COMPANY,
LIMITED,
TIPTON, STAFFORDSHIRE.
LONDON OFFICE:
6, WESTMINSTER CHAMBERS, VICTORIA STREET,
GAS ENGINEERS, IRONFOUNDERS, &c.,
MANUFACTURERS OF
GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED, LAMP-POSTS, PIPES,
AND ALL REQUISITES FOR EITHER
GAS OR WATER WORKS;
ALSO
MAKERS OF ROOFS, BRIDGES, &c.

MANN & OWENS' PATENT GAS-VALVE.

EVERY VALVE WARRANTED TO BE PERFECTLY SOUND AND GAS-TIGHT.



VALVE, with Indicator for Above Ground. UNDERGROUND VALVE.

The advantages of this Patent Valve over all others yet introduced are, that it is always as tight as the best wedge or spring valve, without the possibility of setting fast or becoming suddenly leaky. The surfaces not being in contact during the operation of opening or closing, leakage through wear and tear is avoided.

The Gas Engineer will not fail to see the importance of such a valve in connexion with his purifying apparatus, particularly in the case of large sizes.

The slide being operated either by a screw and nut, or by a pinion and rack, a cam bearing upon a plane, cast on the back of the Valve, forces it against the face, and renders the escape of gas an impossibility. By a slight turn of the pinion or screw, the slide is released, and brought away from the face, by which means friction is avoided, and the only force required to open the Valve is that due to its own weight.

SOLE MANUFACTURERS:
S. OWENS AND CO.,
HYDRAULIC AND GENERAL ENGINEERS,
WHITEFRIARS STREET, LONDON, E.C.
PRICES, SIZES, AND FULL PARTICULARS ON APPLICATION

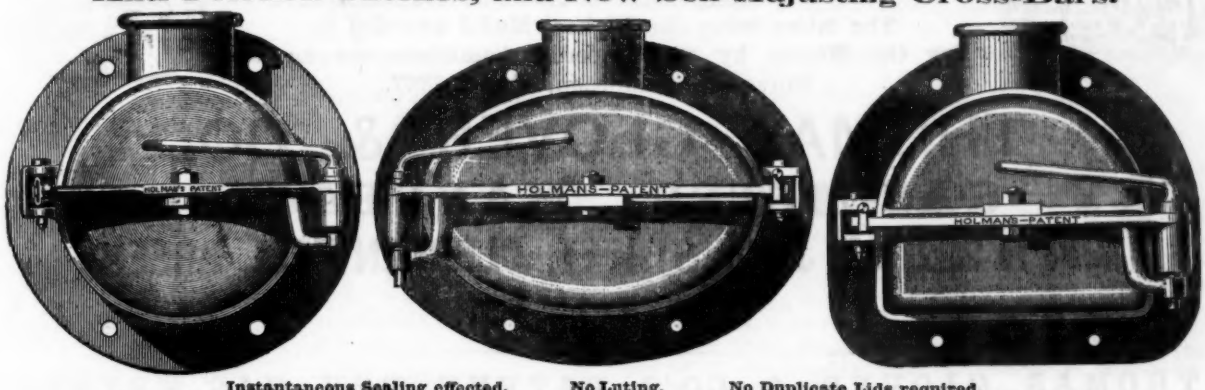
TANGYE BROTHERS AND HOLMAN,

10, LAURENCE POUNTNEY LANE, LONDON, E.C.

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.
Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested (rigid cast iron is now successfully employed), being now in use in nearly all the principal Gas-Works in London and the Provinces.

Messrs. T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT ITSELF (see Illustrations above), instead of, as heretofore, bringing the Mouthpiece from the D or Oval at back to Circular in front.

D and Oval Morton's Lids have now been working satisfactorily for the past two or three years, both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland).

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

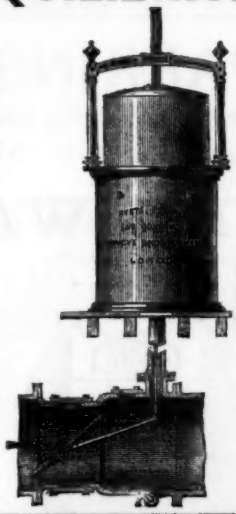
Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.



These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

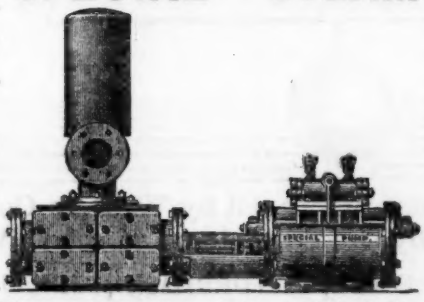
Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,
(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION.

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	20
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS; HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.

London, 1851 New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.

(ESTABLISHED 1816)

ARE THE ONLY MAKERS

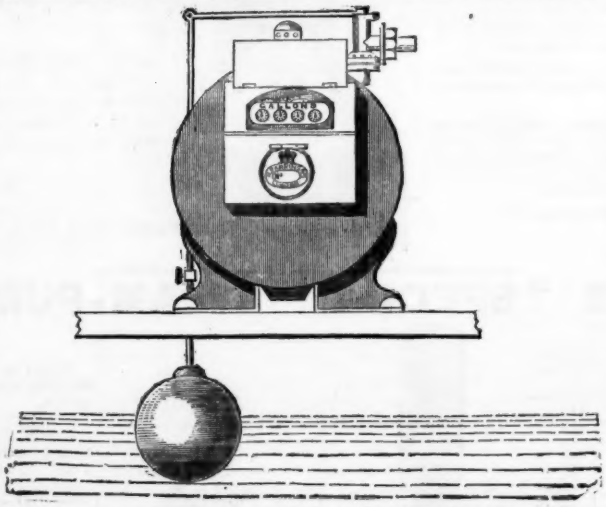
OF THE

LOW-PRESSURE WATER-METER.

These Meters will register with perfect accuracy, either at full speed, or with a few drops only passing through them.

They must be placed over the cistern to be supplied, and the water, after being measured, will fall from the outlet into the cistern below. Each Meter is fitted with a ball-valve, so made that it can be adjusted to shut off the supply at the inlet when the water reaches any required height in the cistern.

The 100-gallon Meter is fitted with a cistern holding about three or four gallons, and may be fixed inside a house, free from the effects of frost, and requires no attention after once being fixed.



From "The Engineer," April 6, 1877.

"Low-pressure Meters have been found to register with almost perfect accuracy, or, at all events, within 5 per cent. either for or against the consumer, and from the nature of their construction are by no means easily deranged. Still, even the low-pressure meters have their disadvantages, but these are chiefly as respects the question of first cost, seeing that they must have a cistern fixed at a higher level than that at which the supply is needed. All things considered, however, the balance of opinion rules at present in favour of the low-pressure Meter, and they are consequently increasing in favour as time goes on."

These Meters have been manufactured by W. P. & Co. for more than 25 years, and are largely used by the following and other Water Companies:—

NOTTINGHAM, DERBY, LEICESTER, SUNDERLAND, GREAT YARMOUTH, SHEFFIELD, NORWICH, LOWESTOFT, COVENTRY, SOUTHEND.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 13, 1877.

Circular to Gas Companies.

We make no excuse for once more alluding to the possible competition of the electric light with gas. The matter still attracts public attention, and some of our scientific contemporaries devote a portion of their space to a discussion of the relative merits and cost of the two modes of illumination. It has never been denied in these columns that, taking candle power as the standard, the cost of the electric light, as produced by a magneto-electric machine, is considerably less than that of gas, but then it is produced in what may be called a concentrated form, and, at the present moment, its divisibility is extremely limited. It may be true, that a light equal to that which would be yielded by one thousand feet of gas may be produced for three-halfpence; but then the gas may be distributed and consumed all over a house, while the electric light must be confined to one room, in which a painful glare would be substituted for the mild and equable light supplied by gas. Thus, for the present, and until means are found for infinitely dividing the intense stream of force which flows from the magnetic coils, the electric light can find no use for domestic purposes. There is still, at the present moment, the further objection that their terminal points will require constant attention. If the wick of a moderator or petroleum lamp required to be changed every hour or two, it would not involve much more trouble than is caused by M. Jablochkoff's "candle." It is a common practice to dream of the possibilities of what science may achieve, and perhaps men are perfectly justified in speculating on a coming time when a single wire under the pavement will convey to every house the means of illuminating it without the production of noxious gases and hot vitiated air. It does not follow, however, that gas shareholders need take fright when these gentlemen publish their adumbrations. It is not so many years since it was proposed to make long journeys in balloons instead of on railways, but railway shareholders were not at all scared. We will not go so far as to say that the parallel is a close one, but may express an opinion that when balloons start two or three times a day from London to, say, Manchester, our houses will be lighted by electricity.

There remains to be considered the applicability of electricity to the illumination of large spaces, covered or not. It is not to be denied, that some success has been obtained in the adaptation of the light to this end, but nothing like so much as some people would have us believe. Large workshops, railway stations, and open public spaces have been illuminated; but, as we said on a recent occasion, the new light has almost invariably been superseded by the old. There are special circumstances under which, no doubt, the electric light may be used with advantage out of doors; but in these cases it does not come in competition with gas, which is usually unattainable. It competes with the lime light, which we regard as more likely to supersede coal gas than electricity. If a cheap and easy method of producing oxygen could be found—and the discovery of such a process we regard as much more probable than the means of dividing a stream of electricity—a great alteration would be possible in our system of public and private lighting. Oxygen could be laid on to every shop and house, just as gas is; it might be used to increase the illuminating power of gas, as was done in Paris and Brussels; or, as we have said, it might be used to produce the lime light in large buildings and public spaces. But it is needless to go on speculating. The idea of using oxygen to heighten the illuminating power of gas is a matter of history, for it is dead and gone. We have a confident belief that the electric light, except as applied to lighthouses, will also soon become a matter of history, and we once more advise gas shareholders to stick to their property.

It will be seen, by a notice in another column, that the three Gas Companies which supplied the city of Melbourne and its environs, and existed, to some extent, in competition, have wisely agreed to amalgamate. They have been guided in their arrangements by home precedents; and it is a matter of regret to us that these precedents have not been more frequently followed at home. It is difficult to see what keeps a number of Metropolitan Companies apart, when so many advantages might be derived by combination. There are also provincial towns, like Hull, the Gas Companies in which might be largely benefited by amalgamation. Perhaps the example set by the leading city at the antipodes may stimulate efforts to closer union at home.

Honours do not fall on gas officials "thick as leaves that "strew the Vallombrosa," and, therefore, we feel great pleasure in recording the fact, that the outgone Lord Mayor distinguished himself by nominating as a Deputy-Lieutenant of the City of London, Mr. John Orwell Phillips, the Secretary of the Chartered Gas Company. That Mr. Phillips will do credit to the appointment, every one who knows him would be well assured. What the duties of the appointment are, beyond appearing on public occasions in very neat uniform, we do not know; but, under whatever circumstances the services of a Deputy-Lieutenant may be required, Mr. Phillips would certainly be equal to the occasion.

We remarked last week, that the gas accounts of the Salford Corporation present some very satisfactory features. As in Manchester, the consumption of gas steadily increases, and last year in a slightly larger proportion than in the latter city. A defect, common to the report of both Corporations, is that they give no information as to working details. We have the quantity of gas made, but we are nowhere told from how much coal it was produced, and we are thus left to infer the goodness or badness of the management from the amount of profit obtained. Looked at in this light, the Salford accounts appear to show highly successful management, for it will be seen that the gross profit obtained by the Corporation is just about one-half that obtained in Manchester, while the sale of gas is rather less than one-fourth. Any comparison of this kind is, however, absurd. We have often expressed a wish that Corporations possessing gas under-

takings would adopt, as far as it is applicable, the form of accounts prescribed by the Board of Trade for the Metropolitan Gas Companies. Some, we are happy to say, have fallen in with our suggestion, and we think advantage would be gained if all did so. It would not preclude them from giving additional and interesting particulars, such as are furnished in the appendices to the Manchester accounts, although we believe that few persons in or out of that city care to trouble themselves about the details given in those documents. A broader and simpler view of the condition of the undertaking would suffice for all practical purposes. Reverting to the Salford accounts, we note with pleasure the improved circumstances of the undertaking. Last year the gross profits amounted to £52,755, against £22,218 in the previous year. The net divisible profit amounted to £9599, as against nothing in the preceding year, and, we rather think, for some years previous to that. Our readers know that we altogether object to Corporation profits; but we are bound to say that the mode of disposing of such profits by the Corporation of Salford appears to us extremely fair, they being distributed among the three districts comprised within their limits, in proportion to the amount of gas consumed in each, and, we infer, are appropriated to improvements within these districts, and not, as in Manchester, paid in a lump sum to one particular improvement-fund. It is hardly necessary to say that the increased profits have enabled the Corporation to diminish the mortgage debt on the undertaking, the interest on which in the past year was only £11,487, as against £12,111 in the previous year. Altogether it would seem that the Salford undertaking has now "turned a corner," and is in a fair way to become as satisfactory as any in the kingdom, and we join with Mr. Hunter in the hope that gas will soon be as cheap and as good in Salford as in Manchester.

The Gas Committee of the Corporation of Macclesfield have made a very favourable report for the last year. The net profits for that period have been £4032, as against £3353 in the preceding year. We find the same fault with these accounts as we have with the others mentioned above; but it ought to be said that these are more confused than most. No details of manufacture are given. Cannel coal cost the Corporation £6078, and the gas sold produced £14,424. The surplus profits appear to be entirely devoted to extension and improvements.

We have also received the gas accounts of the Local Board of Ashton-in-Mackerfield, which no "fellow," except, perhaps, the compiler, can understand. The Board seem to have made a profit on their undertaking, but how and why is not visible in the accounts.

The gas undertaking of the Corporation of Aberdeen is like the great majority of Scottish undertakings, steadily prosperous without bringing in extravagant profits. The balance carried to net revenue account in the past year was £10,886, as against £9703 in the previous year. In these accounts also we lack working details; all we are told is that an expenditure of £23,170 on cannel coal brought for gas and meter rental £43,571.

We have mentioned before that the Corporation of Birmingham have suffered considerable loss from defaulting small consumers, and we pointed out to them the obvious remedy—the rigorous exaction of deposits. The Gas Committee have at last—though, it would seem, somewhat reluctantly—decided on requiring deposits from all consumers who have not kept a satisfactory account with the Corporation for two years. There is nothing unjust in requiring deposits by way of security. The honest consumer does not object to make them, and certainly would not if the money bore a small rate of interest. Mr. Chamberlain, we rather think, would have liked to dispense with the employment of collectors; but he, like everybody else experienced in business, has found that there is a large class of people who have a decided objection to pay their debts, and never do so voluntarily. Pertinacious dunning is but too often necessary to extract money from some people's pockets, and even that sometimes fails. Without the power Gas Companies possess to cut off a supply after due warning, their bad debts would be enormous. We give to Corporations the same advice we give to Companies, and recommend a rigorous collection of accounts with a firm but friendly hand. If we found any fault with the regulations the Gas Committee have advised the Corporation to adopt, we should say they were too mild.

The following is the report of the Gas Committee, with their recommendations to the Council:—

> The Gas Committee report the total number of accounts opened in the gas department for the quarter ending Sept. 29, 1877, was 55,077, of which no fewer than 44,231 were under 20s. each. The total amount of bad debts written off for the half year ending June 30, 1877, was £1437 10s. 1d., of which amount the sum of £1149 12s. 9d. was lost on 1092 accounts, averaging £1 1s. 0½d. each. Bad debts for the three months ending the 30th of September were £819 5s. 3d., of which sum £609 17s. 9d. was lost in 732 accounts, averaging 16s. 8d. each. The average loss due to bad debts amounts to ·29d. per 1000 feet of gas sold. In Nottingham the loss is ·15d. per 1000 feet of gas sold; while in Bolton and Manchester it is only ·03d.; these results being produced by the very stringent regulations for deposit and cash payment enforced by the corporations of the two last-named towns. The difference against Birmingham constitutes a charge upon the ratepayers and the consumers of gas, and in the interest of both it is desirable that all preventable causes of such loss should be removed. A very large proportion of the total loss made is incurred in connection with the change of tenancy, the incoming tenant refusing to be answerable for the account of his predecessor, whose new residence it is frequently impossible to trace. The recent regulations of the Gas Committee were intended to obviate this state of things in the interest of the great majority of the ratepayers; but experience of their working has proved that they are a source of just annoyance and complaint to respectable ratepayers, who are not unnaturally irritated at being included in the operations of rules intended to prevent dishonesty. The committee now propose to adopt the following regulations, which it is hoped may be effectual to prevent unnecessary loss to the ratepayers, and at the same time to remove all grounds for reasonable dissatisfaction the part of the consumers of gas:—
>
> *New Accounts.*—1. Any person who has previously kept a satisfactory account with the corporation, and who applies for a new supply of gas, will be accommodated on the usual credit terms. 2. An applicant who has not been a previous consumer, and whose premises are held on a weekly tenancy, will be asked to leave a deposit sufficient to cover one quarter's consumption. After he has been supplied for two years in the same premises, and the account has been punctually paid, the deposit may be withdrawn, and he will be supplied on the usual credit terms. 3. If the consumer is unwilling to leave a deposit, he may, in lieu thereof, furnish the corporation with a guarantee signed by any person who has had a satisfactory account with the corporation for not less than two years. It will not be necessary that the guarantor should attend personally to sign the guarantee, but a note will be sent to him to inform him if his security has been accepted.
>
> *Change of Tenancy.*—1. Persons about to occupy premises previously supplied with gas are requested to make application, in writing or personally, to the secretary of the gas department before taking possession, in order that the then state of the meter may be ascertained. If such persons have not previously been consumers of gas, the regulations applicable to new accounts must be observed by them. Only in the case of their refusal to do so will the meters be removed.

Our readers will find in another column an interesting discussion on Messrs. Aitken and Young's process, which took place at the recent meeting of the West of Scotland Association of Gas Managers. It is gratifying to see now a pretty general expression of approval of the process. As we said before, whether it is better for a Gas Company to have the light naphthas in the gas, or left in the tar, is a matter which may remain in dispute, except in the case of small works, which have no facility for disposing of their tar to distillers. The naphthaline question was somehow or other mixed up in the discussion, and we may here express a decided opinion that by keeping naphtha vapours in the gas, the deposition of naphthaline is prevented. It is this fact that leads us to think the Aitken and Young process might prove advantageous to gas makers here in the South, who are a good deal troubled with naphthaline. We shall be glad to see Dr. Wallace confirmed in his statement, that the value of the tar is not much depreciated by the process.

The Newbury Town Council have resolved on promoting a Bill in Parliament to extend the limits of the borough, and to enable them to acquire the undertaking of the Newbury Gas Company. The Gas Company having agreed to sell, there will, we expect, be no opposition to the measure. The undertaking is, of course, a small one, but straws show which way the wind blows.

Water and Sanitary Notes.

THE annual report of Mr. Stoneham, the Government Auditor of the accounts of the Metropolitan Water Companies, which appears in another column, is an exceptional document, the like of which we hope never to see again, and for that reason say nothing about it. Major Bolton's annual report, while plainly pointing out certain deficiencies in the plant of some Companies, nevertheless fully recognizes the fact that those Companies are doing their utmost to remedy the defects with all possible speed. In the course of a year or two the Metropolis Water Supply will certainly be in a more satisfactory condition; but what will happen in the meantime it is impossible to say. By a resolution passed at a recent meeting of the Metropolitan Board, the Works and General Purposes Committee were requested to report forthwith generally upon the Metropolitan Water Question, and we shall soon learn the action they will recommend the Board to take. The purchase of the works is, of course, possible, but not, in our opinion, advisable. Leave the companies alone, and all will soon be well. We speak generally, with a knowledge that the supply of two, at all events, leaves nothing to be desired.

Glasgow, like a good many other cities, is greatly troubled about the disposal of its sewage. Our readers will remember the report made by Sir John Hawkshaw, in which he pointed out three alternative schemes for disposing of the sewage. The first, and the one evidently Sir John was in favour of as an engineer, was to discharge it into the sea, on the Ayrshire coast. The others included irrigation, or the treatment by precipitation and the discharge of the effluent into the Clyde. The Town Council of Glasgow have now to decide what plan shall be followed, and, as a preliminary step, they have sent a deputation of their body

to visit towns where different systems for the disposal of sewage have been adopted. The result has been the issue of a report, in which the Committee give a fair account of what they saw, with their opinions on the different systems, concluding with some recommendations as to what they think can best be done under the peculiar circumstances of the City of Glasgow. To carry the sewage to the Ayrshire coast would involve a great expense. To send it at once into the Clyde, some miles below the city, in an unpurified state, would, on account of the sluggish motion of the river, undoubtedly produce a nuisance, which would in a short time become intolerable. Two things, therefore, remain for the Committee to consider—first, the best mode of purification; and, secondly, the best method of keeping the quantity of sewage proper within the narrowest limits. The idea of irrigation was quickly discarded when it was calculated that Glasgow would require a sewage farm having an area of ten square miles, probably involving a loss of £10,000 a year. The chemical treatment of sewage, it is likely, would cost as much, and the Committee fairly recognize that there is but little prospect of obtaining any return for the outlay. A little to our astonishment, precipitation by lime is recommended—in many respects the worst of all precipitants. Lime is considered cheap, and, for aught we know, it may be so in the neighbourhood of Glasgow; but we should have thought that a crude sulphate of alumina, intelligently used, with just sufficient lime to neutralize free acid, would be more efficient, and would greatly reduce the bulk of the sludge. Glasgow contains 100,000 houses, of which only 32,000 possess water-closets. The Committee are naturally desirous of limiting the number of closets, and, for that reason, it will be seen they recommend the tub and pail system, as employed in Birmingham and Manchester. No mention is made in the report of the mode in which it is proposed to deal with the contents of these tubs and pails, which, we fear, will bring small returns to the Corporation of Glasgow. A good deal is said about the ventilation of sewers and the drains of houses. Much nonsense has been written and spoken on this subject. The best plan of ventilating sewers and drains is to give the freest openings everywhere. Traps are traps in a double sense, and ventilation of house-drains by rain-pipes and other means has been shown to be a delusion and a snare. Plenty of openings from the sewers to the roadways render the ventilation of house-drains unnecessary. We have dealt very shortly with the report of the Committee, and here append the recommendations they make to the Council. There is only one further remark to make, and that is about the disposal of the sludge, which differs considerably from river dredgings. Sewage sludge stinks, and the Corporation must be careful where they put it, or they will get into trouble.

Recommendations.

The committee finally recommend—

1. That the system of having water-closets for public works, factories, gaols, workhouses, infirmaries, and railway stations, should be forbidden, so as to reduce the quantity of water-closet sewage now turned into the river. Water-closets in small houses should also be discouraged.
2. That the ordinary privies and ashpits be altered to the tub and pail system, to be cleansed daily, as it has been carried out in Manchester and other important English cities and towns; and that special accommodation be provided for children.
3. That all drains, soil and waste pipes, and all apparatus connected with water-closets, sinks, and baths, and their connections, be executed under public supervision.
4. That a complete system of ventilation of the common sewers throughout their entire length be immediately adopted.
5. That a system of ventilation of the house-drains and soil-pipes, independent of that of the common sewers, be immediately adopted and enforced throughout the city.
6. That the use, for dietetic purposes, of water from cisterns supplying water-closets should be absolutely forbidden.

That in the event of it being found necessary to purify the river—

7. That the whole drainage of the city be taken into main intercepting sewers, and conducted to a suitable point, and after being rendered clear by precipitation and filtration, passed into the Clyde.
8. That the sludge obtained in the precipitation process be got rid of in the cheapest possible manner. A part of it might be utilized in making up waste land, and a certain quantity might be taken away by farmers; but the greater part would probably require to be disposed of in the same manner as the dredgings of the river.

It will thus be seen (continue the committee) that we entirely discard the idea of utilization of the sewage itself, or the precipitate obtained by the action of lime or other chemical agents. The sludge obtained by any of the patented processes is dried at such cost, and its value when dry is so trifling, that all hopes of disposing of it for manurial purposes—at a price that would be remunerative—are entirely illusory. In conclusion, we have to remark that, while we consider the purification of the Clyde an important and necessary work, we are of opinion that, for the health of the city, the recommendations we have made upon the other details of the sewage question are of much greater consequence, and we trust that these will be carried out without unnecessary delay.

To-morrow will be a great day in Spring Gardens. At a special meeting of the Metropolitan Board, the Works and General Purposes Committee are to report as to the desirability of purchasing the existing water undertakings in the Metropolis, and also on the scheme devised by Messrs. Bazalgette, Bramwell, and Easton, for furnishing an additional supply for extinguishing fires, and for dietetic purposes. The remark at the end of the notice paper, that forms of *Gazette* advertisements will be submitted, leads us to believe that the committee will recommend both the purchase of the companies and the carrying out of the new scheme. It is impossible to exaggerate the importance of this question to the Metropolis at large. London is at present an enormous district, which is liberally supplied with water of fair quality, without any risk to the ratepayers. The charge for the supply, though it may be admitted to be in a few cases exorbitant, is as low as in any city in the kingdom. Nothing whatever can be gained by a transference of the undertakings to the Metropolitan Board. The water-rates would not be lower; the supply would not be more abundant. The only probable consequence of the change would be vexatious interferences, and a most unpleasant system of supervision. Under the Companies, the public are left free to use or waste water as they please. This *laissez-aller* system we do not approve of, and we have often counselled the Water Companies to exert a more vigilant superintendence. If the undertakings should by any chance fall into the hands of the Metropolitan Board, all will be changed; the consumption of every gallon of water will be narrowly watched, and restrictions will be imposed at every point. If the ratepayers choose to submit to this, all well and good; we make no objection. If the Companies are paid a fair price for their property, we should not resist the transfer. But we wish it to be distinctly understood that there is nothing to be gained by the transaction. Water will not be more plentiful in London, and rates will not be lower, while the public burden will be enormously increased. We say nothing about the newly-devised scheme, which, if carried out, will add so largely to the metropolitan debt, without, in our opinion, producing any commensurate advantage. A high pressure service can be hardly necessary in the Metropolis, where the supply of water is so abundant. To what extent hydrants supplied by water at high pressure could possibly supersede the services of the fire brigade is altogether unknown, and would take the experience of years to determine. In any case, at least ten years must elapse before the new additional system can be brought into operation. To-morrow's debate will give us the opinions of the members of the Metropolitan Board; but two other parties have to be consulted—first of all, the ratepayers, who cannot be said to be represented by the Board; and, next, the Water Companies, who represent themselves. The former, we think, will object to the addition of £26,000,000 to the metropolitan debt, and the latter will most strongly object to extinction, except on the most liberal terms. The subject is the most momentous the Board have ever had to consider, and we hope the members will rise to the occasion, and bring all the intelligence they possess to bear on the question.

The negotiations between the Corporation of Bristol and the Bristol Water Company are for the moment suspended, but it seems probable that the undertaking will pass into the hands of the Corporation next year. Terms have, in fact, been virtually arranged on the following basis:—The Corporation to pay twelve per cent. upon the original stock of £200,000, and ten per cent. upon all other ordinary stock from the 1st of January, 1884, and thenceforth in perpetuity.

Typhoid fever has broken out in some wretched tenements in Accrington, and since the water supply is in the hands of a Company, some itinerant agitator pounces on the water as the cause. We imagine the water has not a particularly inviting look. It is collected in boggy ground, and no doubt is peaty, but that it is the cause of typhoid fever no one but a sensational analyst would suggest. The Company, willing, and indeed anxious, to do their best, have proposed to the Local Board that Dr. Angus Smith, F.R.S., should be called in to examine and report upon the water, and the Board have consented to the appointment. No better man could have been selected. He is perfectly free from prejudice, and, at the same time, is quite fearless in the expression of his opinions.

When a man has a well in his back yard close to his privy, and only 75 yards distant from a burying-ground, the water is very likely to become contaminated by disagreeable organic matter, and if typhoid fever be really caused by drinking such water, it ought certainly to break out in that house. It appears to have done so in the house to which we allude, which is in the district of the Local Board of Audley, who proceeded against the owner and occupier, under the 70th section of the Public Health Act. The Magistrates felt a difficulty in deciding whether the well should be temporarily or permanently closed, but decided eventually only to close it temporarily. Objecting, as we do, to the compulsory closing of wells, the water from which has been drunk by many successive generations, without any apparent injury to health, we are bound to say in this case, supposing the analysis of the water is correct, the well is very properly closed, the water being only fit for manuring the proprietor's garden. Holding, as we do, that the powers given by

the Public Health Act, and by some Corporation Water Acts, should, in justice to owners and occupiers, be exercised with care and moderation, we are free to admit that there are instances in which such powers should be peremptorily enforced.

A curious case, which will probably test the power of the Local Government Board, is pending at Honiton, where, on the report of the Medical Officer of Health, two Magistrates ordered a well to be closed, and accordingly the pump-handle and sucker were removed and deposited in the Mayor's back yard. The Town Council and the inhabitants of Honiton are, however, divided in opinion, the majority apparently holding that the suspected well is harmless. Thus it happened that a few days ago a strong party visited the Mayor's residence, and claimed the pump-handle. On being refused, they penetrated his back premises, and seizing the handle and sucker carried them off, and triumphantly fixed them to the pump. This proceeding, however lawless, is supported by a majority of the Council, and will, no doubt, necessitate the interference of the Local Government Board. We need not allude to the scenes in the Council Chamber, which are eminently calculated to bring local self-government into contempt.

After the Exeter Water Company have offered to sell their undertaking for eight per cent. annuities, the Town Council have resolved to ask them to take seven per cent. The lever they employ is a projected new Company, which does not make much progress, and is never likely to obtain statutory powers. The Company, we expect, will hold their own, and, if they would only filter the water better, might do so for some years to come.

The Town Council of Scarborough have resolved on making an attempt to acquire by agreement, or under compulsion, the undertaking of the Scarborough Water Company. It is not denied that the Company, who originally took over the water-works from the Corporation, have well supplied the inhabitants, at lower rates than they were authorized to charge; but now that the Company are compelled to raise a considerable amount of capital for necessary extensions, the Town Council have been seized with the prevailing mania, and desire to get the undertaking into their hands again, with the vain idea that they can do better for the town.

WATER LEGISLATION IN 1877.

THE following Water Acts relating to Corporations were passed during the last session:—

The *Blackburn Borough Gas, Water, and Extension Act* authorizes the Corporation to abandon some water-works they were empowered to construct in 1875, and gives powers for constructing works in substitution. The works are of an extensive character, for which they have power to borrow £43,000.

The *Bridgwater (Corporation) Water Act* is to empower the Bridgwater Corporation to construct water-works to supply the borough, and for this purpose to borrow £33,000. The rates the Corporation can charge for water, for a supply for domestic purposes, are about as usual. The water for other than domestic purposes is to be supplied by agreement.

The *Edinburgh and District Water-Works Act* gives power to abandon certain works, and to construct others.

The *Glasgow Corporation Water-Works Amendment Act* is to authorize the Water Commissioners to raise a further sum of money, and make additional works. The Act gives the Commissioners power to borrow to the extent of £450,000, in addition to the £1,400,000 already expended for water purposes.

The *Leeds Improvement Act*, among other things, authorizes the Corporation to enlarge their existing water-works, and for that purpose to borrow a sum not exceeding £250,000. The Act gives the Corporation power to supply both gas and water fittings, and to do all kinds of work in connection therewith. It further authorizes the Corporation to make and enforce stringent regulations for the prevention of waste and misuse of water.

The *Perth Water Act*, first of all, dissolves and re-incorporates a body of Commissioners, constituted under the authority of an Act passed in 1829, with power to purchase the Bridgend of Perth Water Company, Limited, and also some small works constructed by the Earl of Kinnoull for the supply of his tenants. The newly-incorporated body of Commissioners are further authorized to construct water-works in addition to those now in existence. The consideration to be paid to the Limited Company is to be settled by agreement or by arbitration, and the same provision is made in respect of the undertaking of the Earl of Kinnoull. For all these purposes the Commissioners are empowered to borrow a sum or sums not exceeding £35,000. The limits of compulsory supply include the City and Royal Burgh of Perth, and beyond these, an area included within the radius of one mile in all directions constitutes the entire water limits. The rate for a domestic supply within the compulsory limits is to be made annually on an estimate. A public rate may also be levied, which is not to exceed one penny in the pound of the full annual value. Beyond the compulsory limit the charge for water is to be arranged by agreement between the Commissioners and owners and occupiers, and the charge for a supply by measure for other than domestic purposes is also to be settled by agreement. Any surplus profits obtained by the Commissioners is to be applied to the reduction of the domestic water-rate. The Act provides that after the 13th of September, 1878, the Police Commissioners may, if they think fit, take over the undertaking.

The *Ramsgate Local Board Act* empowers, *inter alia*, the Ramsgate Local Board to purchase the undertaking of the Ramsgate Water Company. The consideration to be paid is a lump sum of £70,000, with the sum of £120 for the coal in store. The Board obtain power to borrow £90,000 for water purposes. The rates that the Local Board may charge for water for domestic purposes are about as usual. The charge for water to be supplied by meter is to be settled by agreement. It is hardly necessary to say that the Act grants all the powers usually conferred on a water undertaking, whether in the hands of a Company or a Local Authority.

The *Rotherham Corporation Act* is simply to extend the time allowed to the Corporation, by the Act of 1870, for the completion of their water-works.

The *Wakefield Improvement Act*, among other things, empowers the Corporation of Wakefield to acquire the undertaking of the Wakefield Water-Works Company. The consideration to be paid is a lump sum of £164,904, free of all deductions, the Corporation taking over all the debts and liabilities of the Company. The purchase-money is practically £48 for every £25 share. So far as this Act gives evidence, the Corporation have no intention of altering the source of supply. The Act authorizes the Corporation to raise £210,000 in respect of their undertaking.

The *Reservoirs Act* is a promising piece of legislation, introduced by Mr. Whalley to enable landlords with limited interests to charge their estates, with the consent of the Inclosure Commissioners, with the expenses of constructing reservoirs and furnishing a supply of water. The consent of the Commissioners is made to depend on a sort of guarantee that the value of the estate so charged will be enhanced by the proceeding. In one instance, however—that is, furnishing a supply to tenants resident on the estate—it is not necessary to show that the scheme would be directly profitable. We do not expect that much will come of this Act. Few landlords in England, we fear, are likely to engage in the water enterprise. Nevertheless, if they are disposed to do so, this Act gives them facilities of which they may be glad to avail themselves. Mr. Whalley certainly deserves the thanks of the country for the promotion of a measure which may confer great benefits on our rural populations.

TESTING AND STAMPING OF WATER FITTINGS.—Mr. Gale, engineer, has reported to the Sub-committee on Works of the Glasgow Corporation Water-Works Committee that he had been waited upon by a deputation from the Master Plumbers Association of Glasgow, in reference to the notice recently issued, relating to the testing and stamping of nose, stop, and tube cocks. The deputation represented that the members of the association had on hand a large stock of the articles referred to, which did not conform to the requirements of the notice, and could not be worked up in the ordinary way in less than six months; that they had contracts in hand at old schedule rates; and that in some of these the fittings were already fixed, but would not be ready for the water being turned on for some months after the 1st inst., the time specified in the notice. In these circumstances, the members of the association asked that all fittings now in stock be stamped, and that fittings in buildings already in progress be allowed to pass. The sub-committee, after consideration, authorized Mr. Gale—(1) to stamp such of the fittings now in stock as were approved of by him, (2) to turn on the water to newly-completed buildings, or buildings in course of completion, in which unstamped fittings had been used, provided such fittings were placed there on or before the 1st inst.

COST OF PUBLIC LIGHTING IN THE PROVINCES.—At the meeting of the Newcastle-under-Lyme Town Council on the 30th ult., Mr. Sparkes, the local gas examiner, read a report, which he had been requested by the council to prepare, on the comparative cost of street lighting in towns having a population similar to Newcastle. The report was based on returns from nearly 50 towns, in which many different arrangements between the local authorities and the gas companies were explained, and a statement was drawn up of the cost of street lighting reduced to the Newcastle standard—viz., lamps the property of the gas company; lighting, cleaning, and repairs paid for by the gas company; lamps lighted ten months in the year. The returns, which did not agree with this standard, were reduced so as to agree with it, an allowance being made for towns in which the lamps belonged to the corporation, or where the lighting and cleaning were paid for by the corporation, or where the lamps were lighted more or less than ten months in the year. The average amount paid for lamps which were lighted twelve months in the year was £3 6s. 8½d., the average for ten months lighting was £3 3s. 4¼d., the average for nine months lighting was £3 1s. 2¾d. per lamp. The highest amount paid, calculated at the standard mentioned in the report, was at Whitehaven, where the lamps cost the ratepayers £4 11s. 7d. each per annum. The lowest was Wakefield, £2 0s. 10d. each; intermediate between these was Longton, £3 5s.; Newcastle, £2 19s.; Hanley, £3, but, the lamp-pillars belonging to the corporation, an addition of 5s. was made, making a total cost to the ratepayers of £3 5s. per lamp; Longton, £3 5s.; Stoke, £2 12s. 6d., which, with the addition of 5s. per lamp on account of the lamp-pillars belonging to the corporation, made a total of £2 17s. 6d.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXLIX.

TABLES OF THE DISCHARGE OF GAS IN CUBIC FEET PER HOUR, THROUGH PIPES OF VARIOUS DIAMETERS AND LENGTHS, AT DIFFERENT PRESSURES (*continued*).

By THOMAS G. BARLOW. Extended by THOS. NEWBIGGING.

(The specific gravity of the gas is taken at ·4, air being 1.)

Diameter of Pipe, 5 Inches.

Length in Yards	100.	250.	500.	750.	1000.	1250.	1500.
Quantity delivered with 0·1 inch pressure	3,540	2,245	1587	1296	1122	1000	910
" " 0·2 "	5,005	3,174	2245	1832	1587	1414	1296
" " 0·3 "	6,514	3,888	2748	2245	1943	1732	1575
" " 0·4 "	7,526	4,759	3174	2592	2245	2000	1820
" " 0·5 "	8,438	5,333	3773	2888	2508	2236	1934
" " 0·6	9,214	5,839	4118	3174	2748	2449	2245
" " 0·8	10,665	6,750	4759	3881	3174	2828	2596
" " 1·0	11,914	7,526	5333	4354	3773	3174	2877
" " 1·2	13,061	8,235	5839	4759	4118	3679	3375
" " 1·5	14,614	9,214	6514	5333	4590	4118	3540
" " 1·8	15,998	10,125	7156	5839	5063	4523	4118
" " 2·0 "	16,875	10,665	7526	6143	5333	4759	4354
" " 2·5 "	18,866	11,914	8438	6885	5940	5333	4860

Diameter of Pipe, 6 Inches.

Length in Yards	250.	500.	750.	1000.	1250.	1500.	1750.
Quantity delivered with 0·1 inch pressure	3,770	2,660	2170	1880	1680	1530	1420
" " 0·2 "	5,320	3,770	3130	2660	2370	2170	2010
" " 0·3 "	6,530	4,620	3770	3270	2920	2660	2460
" " 0·4 "	7,540	5,320	4340	3770	3360	3060	2840
" " 0·5 "	8,408	5,970	4860	4210	3770	3430	3180
" " 0·6 "	9,185	6,512	5320	4620	4130	3770	3460
" " 0·8 "	10,643	7,528	6124	5320	4740	4340	4020
" " 1·0 "	11,858	8,408	6853	5929	5320	4860	4500
" " 1·2 "	13,025	9,185	7528	6512	5832	5297	4929
" " 1·5 "	14,580	10,303	8408	7290	6512	5970	5500
" " 1·8 "	15,941	11,275	9185	7970	7139	6512	6026
" " 2·0 "	16,816	11,858	9720	8408	7528	6853	6360
" " 2·5 "	18,808	13,268	10,838	9380	8408	7679	7096

Diameter of Pipe, 7 Inches.

Length in Yards	250.	500.	750.	1000.	1250.	1500.	1750.
Quantity delivered with 0·1 inch pressure	5,560	3,920	3,200	2,780	2,470	2,270	2,100
" " 0·2 "	7,840	5,560	4,510	3,920	3,500	3,200	2,960
" " 0·3 "	9,600	6,800	5,560	4,800	4,300	3,920	3,640
" " 0·4 "	11,120	7,840	6,400	5,560	4 940	4,540	4,200
" " 0·5 "	12,370	8,750	7,180	6,200	5,560	5,060	4,680
" " 0·6 "	13,554	9,585	7,840	6,800	6,080	5,560	5,130
" " 0·8 "	15,611	11,047	8,996	7,840	7,020	6,400	5,930
" " 1·0 "	17,463	12,370	10,054	8.732	7,840	7,180	6,610
" " 1·2 "	19,170	13,554	11,047	9.585	8,533	7,805	7,210
" " 1·5 "	21,433	15,148	12,370	10,716	9,585	8,750	8,120
" " 1·8 "	23,477	16,597	13,554	11,709	10,452	9,585	8,864
" " 2·0 "	24,740	17,463	14,288	12,370	11,047	10,054	9,360
" " 2·5 "	27,651	19,567	15,942	13,825	12,370	11,292	10,452

Diameter of Pipe, 8 Inches.

Length in Yards	250.	500.	750.	1000.	1250.	1500.	1750.
Quantity delivered with 0·1 inch pressure	7,760	5,470	4,470	3,880	3,460	3,160	2,920
" " 0·2 "	10,940	7,760	6,310	5,470	4,880	4,470	4,130
" " 0·3 "	13,400	9,450	7,760	6,700	5,980	5,470	5,050
" " 0·4 "	15,520	10,940	8,940	7,760	6,920	6,320	5,840
" " 0·5 "	17,280	12,200	9,900	8,640	7,760	7,020	6,520
" " 0·6 "	18,922	13,383	10,940	9,450	8,480	7,760	7,150
" " 0·8 "	21,851	15,379	12,614	10,940	9,780	8,940	8,260
" " 1·0 "	24,365	17,280	14,083	12,182	10 940	9,900	9,237
" " 1·2 "	26,767	18,922	15,379	13,383	11,923	10,886	10,109
" " 1·5 "	29,894	21,082	17,280	14.947	13,383	12,200	11,300
" " 1·8 "	32,746	23,155	18,922	16,330	14,602	13,383	12,355
" " 2·0 "	34,560	24,365	19,872	17,280	15,379	14,083	13,040
" " 2·5 "	38,621	27,302	22,291	19,267	17,280	15,725	14,602

Diameter of Pipe, 9 Inches.

Length in Yards	250.	500.	750.	1000.	1250.	1500.	1750.
Quantity delivered with 0·1 inch pressure	10,400	7,380	6,350	5,200	4,650	4,250	3,950
" " 0·2 "	14.760	10,400	8,500	7,380	6,480	6,000	5,620
" " 0·3 "	18,000	12,780	10,400	9,000	8,300	7,380	6,800
" " 0·4 "	20,800	14,760	12,700	10,400	9,300	8,500	7,900
" " 0·5 "	23,182	16,500	13,420	11,900	10,400	9,680	8,800
" " 0·6 "	25,369	17,933	14,760	12,780	11,400	10,400	9,650
" " 0·8 "	29,306	20,667	16,938	14,760	13,100	12,000	11,050
" " 1·0 "	32,805	23,182	18,918	16,403	14,760	13,420	12,380
" " 1·2 "	35,867	25,369	20,667	17,933	16,064	14,653	13,559
" " 1·5 "	40,131	28,409	23,182	20,011	17,933	16,500	15,200
" " 1·8 "	43,959	31,055	25,369	21,979	19,683	17,933	16,621
" " 2·0 "	46,364	32,805	26,681	23,182	20,667	18,918	17,600
" " 2·5 "	51,832	36,632	29,853	25,916	23,182	21,105	19,574

(*To be continued.*)

Communicated Article.

THE NON-PISTON AGE OF THE STEAM-ENGINE.

By Mr. WILLIAM MANN.

(*Continued from p.* 640.)

PONTIFEX'S WATER-RAISING ENGINE.

The accompanying engravings, figs. 5 and 6, show the water-raising engine described in Pontifex's patent, in which *b b* are two steam cylinders, connected by cross tubes at *c c*, in each of which a vacuum is alternately formed by the condensation of elastic vapour, conducted from the boiler by the bent tube, *d*, and admitted to the steam cylinders by means of the slide-valve, *e*. *f f* are two tubes perforated with small holes for the admission of steam and injection water, the latter of which is distributed by falling on the strap, *g*. *h* is the suction-pipe, proceeding nearly to the bottom of the well, which in no case ought to exceed from 28 to 30 feet in depth, so that, a vacuum being formed in the copper vessels, *b b*, the water will be raised by the pressure of the atmosphere, and passing up the tube, *h*, will take the place of the elastic vapour. *i i* are two valves placed at the upper end of the suction-pipe, *h*, which allow the upward passage of the water from the well, but prevent its return. *j j* are two similar valves opening into the air vessel, *k*, to which is attached the nozzle, *l*, serving to convey the water from the copper cylinders to any required point; *m*, the injection-tube, furnished with a valve, and intended to convey water from the box, *n*, to the taper tubes, *f f*; *p*, stopcock to regulate the supply of condensing water. There is a tube passing from the bottom of the cistern, *n*, to the injection-tube, *m*, and furnished with a stopcock at *s*. To put this engine in action, one of the buckets must now be made to descend, which will open the slide-valve, *e*, and admit the steam into the right-hand cylinder, *b*. The atmospheric air, which will thus be expelled from the cylinder, is allowed to pass through the valve, *j*, and nozzle, *l*. The other bucket must then be depressed, and by this action on the slide-valve it will open a communication for injection water through the pipe, *c c*, which water, passing down the perforated tube, *f*, will immediately condense the steam, and form a vacuum in the vessel. The whole pressure of the atmosphere being now removed from the suction-pipe, *h*, the water will rush up to restore the equilibrium, and, the vessel, *b*, being filled, will furnish a supply at the bent tube, *l*. Having examined the action of one half of the apparatus, we may suppose the same effect to be produced on the opposite side. The steam will, in the first instance, be admitted by the pipe, *c*, and a communication afterwards opened by means of the slide-valve with the condensing water, which, by condensing the steam, will form a vacuum, and the water will again ascend as in the first vessel. The stopcock, *y*, must now be opened, and the bucket, *x* (first described), made to descend, which will restore the slide-valve, *e*, to its original position, and, admitting the steam to the upper part of the first vessel, will depress the water, and cause it to flow through the valve, *j*, and nozzle, *l*, while at the same time water will pass through the tube, *u u*, in which the valve, *w*, is inserted, beneath the inverted vessel, *v*. The water will continue to enter the bucket, *x*, till its increasing weight causes it to preponderate, and turn the slide-valve, *e*, in the opposite direction. Should there not be a sufficient supply of water in the cistern, *r*, for the purpose of condensing the steam in the larger vessels, the stopcock, *p*, must be opened, and an additional supply of water will then be furnished from the chambers, *n n*, by the tube, *m*: and, in the event of the bucket not being depressed at the instant that the water is expelled from the chamber, *n*, of the vessel, *b*, the steam will pass through the tube, *u u*, and act between the under side of the fixed inverted vessel, *v*, and the surface of the water in the moveable bucket, *x*, the descent of the bucket being accelerated by the repellent force of the steam, so that by the alternate action of the buckets, *x x*, the motion of the engine is rendered continuous.

FIG. 5.

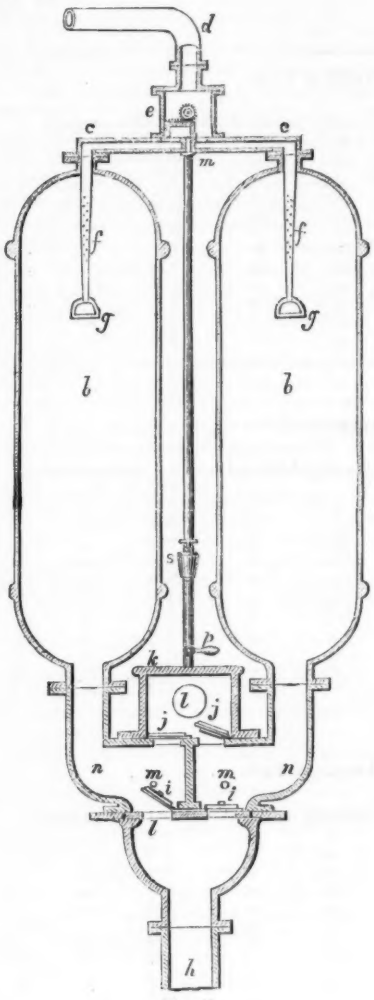


FIG. 6.

THE PULSOMETER.

This seems to be a strange name for what is, after all, only a rough-and-ready steam-pump, an implement by which so many gallons of water per hour are raised by the consumption of an ungiven quantity of fuel. Notwithstanding, as it possesses some unusual properties, it is worth while to understand them.

The engraving, fig. 7, exhibits a vertical section of the Pulsometer, taken through the centre of the water-chamber. It will be seen that the pear-shaped body of the apparatus is internally divided into two chambers, A A, separated by a vertical partition extending laterally on each side at the upper part, where it forms an elliptical air-chamber, B, one side of the diaphragm communicating with the delivery, and the other with the suction. C is the induction passage for the passage of the fluid to be raised, opening out on either side into the chambers, A A, and fitted with valves, E E. D is the discharge, the chamber of which is provided with two valves, F F. Guards, G G, control the valves, E E, as to their degree of aperture, and the openings at the lower part of the chamber are closed by covers, H H. The chambers, A A, are surmounted by a neck, J, bolted thereto, and the two passages of the chambers open into a steam-chamber, in which a ball-valve, I, is fitted, capable of oscillating between the duplex valve-seats formed at the junction. The cylinder and air-chamber are furnished with air-cocks. The pipe, K, is for the admission of the steam, which passes down

FIG. 7.

that side of the neck left open by the position of the valve, I. Entering the chamber, the steam presses on the surface of the contained liquid, which is driven out on the opposite side, through the discharge opening, D, into the rising main.

But what of the claims of this remarkable pump? The inventors tell us that it "can never be worn out." This, of course, is only a joke, and not intended to mislead; for, printed with the Pulsometer price list, we get a catalogue of all the renewable parts, and the cost thereof, just as from the pump makers who do not pretend to supply indestructible apparatus. It "will pump almost anything." This is good. It is to be wished that the vendors could also say, after the manner of the Marquis of Worcester, that it is "an engine so contrived" that it will in an incredibly short space of time so "pump" the Thames Conservancy and Metropolitan Board of Works as to ascertain their motives with regard to the drowned-out dwellers by the Thames, and so helm them that "their forward or backward, upward or downward, circularly or otherwise, to-and-fro, straight, upright or downright tendence do not hinder, much less stop, the other; but unanimously and with harmony agreeing, they all augment and contribute strength unto the needed work and operation, and, therefore, we call this a *semi-omnipotent engine*, and do intend that a model thereof be buried with us."—(*Century of Inventions.* Emended translation.) The "semi" spoils the whole affair. No power that will admit of this prefix can bring about such a joyful consummation; consequently, we must return to the Pulsometer as we find it.

The statement that it "needs no skilled attendance" cannot be claimed as new, for practice shows us that this maxim has been held by the users of steam power from its birth, and is likely to continue until the law declares that a man is not fit even to look after a Pulsometer (at all events until it has received one more improvement, and is able to do without a boiler altogether), who would hang a heavy coat to dry on the end of a safety-valve lever, and think nothing of it; much less one who would wedge down the valve to get rid of the noise of the steam blowing off.

If boilers are not false witnesses, they may be said to have proclaimed aloud, times without number, to the inhabitants of surrounding neighbourhoods, that the absence of skilled attendance is present with them as palpably as the *débris* of explosions; therefore, we may fairly object to this unhonoured practice being considered as novel.

Another claim should be noticed, because it is not the cheapest thing that is at all times the most profitable. It "is cheaper than any other pump." This, of course, means that its first cost is less than any other pump of equal water-raising power. That may be, but there is something else to be considered besides this. In the matter of steam power, there is that every-day demand in the shape of fuel, of which we hear nothing in the shape of comparison with steam-pumps of the piston type. Let it not be said that comparisons are not made, because it is stated that "a comparison of our price-list with those of other makers will show that it is cheaper than any other pump"—cheaper to purchase.

The matter of fuel is referred to rather indirectly by comparison with Savery's engine of 179 years ago, the force of which we cannot see, if it be not intended merely to show that the superiority of the one over the other is due to the mechanical advantages of the present day compared with those of Savery's time. Savery said, "I will raise you water 500 or 1000 feet high, could you find us a way to procure strength enough for such an immense weight as a pillar of water of that height; but my engine, at 60, 70, or 80 feet, raises a full bore of water with much ease." Hall says that "the only way in which deep mines could be drained by Savery's engine was to erect a series of engines vertically one above the other, usually at a distance of some 60 to 90 feet." Other drawbacks not found in the Pulsometer were naturally experienced in the use of this early type of water-engine. (1) It was needful, in the then state of mechanical science, to place the boiler near the engine, and both were necessarily fixtures, so that if the water rose some 20 or 30 feet in the mine, the boiler and engine were drowned out. (2) The expense of fuel was excessive, in consequence, first, of the loss by contact of a large area of steam with the water all through each stroke; and, secondly, of the extravagant method of effecting condensation by a shower of water alternately directed upon each vessel.

From this we have a right to infer, if we had no other knowledge to guide us, that much loss of steam comes of the contact with cold surfaces, and although for other reasons the water-chambers of the Pulsometer are made of a peculiar shape, the cooling mischief is not got rid of by Mr. Hall, the patentee of the instrument, notwithstanding innumerable experiments. Take it that 50 gallons of water are to be raised at each stroke, there must, of course, be a vessel capable of holding that quantity, the internal surface of which must be equal to a certain area, and to this area as the water is expelled will the steam be gradually and ultimately exposed, and as water takes heat very slowly when applied to its surface, the cooling area of the water compared with the metallic, which is a good conductor of heat, is hardly worth naming.

The water having been expelled, the chamber is full of steam, which must be speedily condensed, that one vessel may again fill with water whilst the other is being discharged, and so on. It was, and still is, important that these operations keep time, in order to get a full and efficient stroke at each alternation. Savery's engine being manual, his remarks respecting this are worth quoting: "On the outside of the vessel you may see how the water goes out as well as if the vessel were transparent; for as far as the steam continues within the vessel, so far is the vessel dry without, and so very hot as scarce to endure the least touch of the hand. But as far as the water is, the said vessel will be cold and wet where any water has fallen on it, which cold and moisture vanish as fast as the steam in its descent takes the place of the water; but if you force all the water out, the steam or small part thereof going through, will rattle the clack" (the valve in the rising-main), "so as to give sufficient notice to change the cocks, and the steam will then begin to force upon the other vessel without the least alteration in the steam" (as regards pressure), "only sometimes the stream of water will be stronger than before, if you change the cocks before any considerable quantity of steam had gone up the clack; but it is better to let none of the steam go off, for that is losing so much strength" (so much fuel), "and is easily prevented by altering the cocks some little time before the vessel is emptied."

The equivalent to "altering the cocks, some little time before the vessel is emptied" was ingeniously provided for by Mr. John Pontifex, in an engine constructed soon after his patent (1819) for "Improvements on Savery's Engine," and erected at the City of London Gas Company's works, Dorset Street, Blackfriars. The remains of this engine were preserved by the writer until within a short time of the amalgamation of the company with the Chartered Gas Company, and the consequent abandonment of the site for gas manufacture.

It will be seen, by a reference to the engraving at the head of the present article, that for the same purpose (the injection excepted) for which the "steam-ball" is employed in the Pulsometer, Pontifex supplied a slide-valve, actuated by a simple self-acting arrangement, which may be thus explained. Connected with the valve-gear were two small buckets, one to each water-cylinder, into which alternately a small stream of water could flow. Each bucket contained, when nearly full, a weight of water sufficient to shift the valve. At a point near the bottom of each cylinder, and, consequently, near the end of each discharge or stroke, was an orifice, to which was fixed on the outside a small pipe, bent at the end, and looking downwards, to which was screwed an inverted vessel that fitted into each bucket when up to the point where the water was received, like a cover, with a deep rim that reached nearly to the bottom of the said bucket, for a purpose to be described. Suppose one of the buckets to be in this situation, and the cylinder to which the bent pipe and cover are attached full of water, the slide-valve will be in the position to admit steam, therefore the outflow of the water will immediately commence through the pipe connecting the cylinder with the rising main, and a little time before the cylinder is empty, the bucket having received its required weight of water from the said cylinder through the small pipe fixed thereto, descends and shifts the slide-valve; the other cylinder, having filled by reason of the vacuum formed therein, follows the same routine.

The object of the inverted vessel being within the bucket when up to the "bent" pipe was, that if the water should be expelled down to this pipe before the bucket had received water enough to start the slide-valve, a dash of steam through this pipe, on to the surface of the water under cover of this inverted vessel, would give the valve the start, causing it to become immediately reversed, and preventing the chance of steam "going up the clack."

The steam in the Pontifex engine we have seen was condensed by injection; therefore, could only be used for pumping water. It could not have been used for pumping gas tar or ammoniacal liquor, for the tar distiller does not want water mixed with his tar, nor does the gas manager want water, especially hot water, added to his liquor to *reduce* its strength. Although the steam in the Pulsometer is not condensed by injection, but rather by absortion, yet the volume used to lift or pass on the water or other fluid must be condensed, as well as the steam that "blows through with a certain amount of violence," and the resulting condensement mingled with what is being pumped. It is manifest that Savery and Pontifex's aim was to *use* no more steam than was necessary to discharge their cylinders, and to *lose* no more than was due to contact with cold surfaces. For this reason, therefore, Savery shut in the steam and applied water to the exterior of the vessel, whilst Pontifex, with more light and mechanical skill at his command, applied the water for the condensation of the steam to the interior of his cylinders. Both men were clearly working to prevent the sort of indefinite loss due to blowing through to the rising main, and to form their vacuums by condensing the steam, and only that portion of it which was left after the fluid had been expelled.

This brings us to show how the vacuum is produced in the chambers of the Pulsometer, and here it must be confessed that there seems to exist a sort of hap-hazardness about the operation. It is said that "the moment the level of the water is as low as the orifice which leads to the discharge, the steam blows through with a certain amount of violence" (violence is the right word), "and being brought into intimate contact with the water, *an instantaneous condensation takes place*, and a vacuum is in consequence so rapidly formed in the just emptied chamber, that the steam ball is pulled over into the seat opposite to that which it had occupied during the emptying of the chamber, closing its upper orifice and preventing the further admission of steam, allowing the vacuum to be completed." This is not clear. It is difficult to understand how "a vacuum is rapidly formed in the just emptied chamber," whilst the steam is rushing through full bore, nor how the ball will leave the seat of the filling chamber until that chamber is full and the vacuum gone. It would seem that the vacuum can only be formed after the ball has changed its place. It has before been remarked that it is claimed for the Pulsometer that it will pump almost anything. In a sense this may be admitted; and, no doubt, whilst employed in pumping water, it can be brought to a fair condition of *beat* by the use of the steam-regulating valve and air-cocks. This condition gives the maximum of work with the minimum of fuel, whatever that may be. Any one who has paid attention to the principle of the Pulsometer's action will have noticed that it is due to the formation of a vacuum within

the body of the pump itself, and not in a separate vessel, consequently, water cannot always be used for that purpose, as in the condensing steam-engine, and, therefore, however unsuitable the fluid passing through the pump may be for forming a vacuum, it must be accepted, as no other can take its place. There is a difference, however, between the condensing engine and the Pulsometer, with regard to the mode by which the steam and water, or other fluid, are brought into contact. In the first, water is injected into the steam; in the second, the steam is injected into the water or other fluid, and should the fluid be such as to form the vacuum slowly (as with oils or tars), the pumping will be slow, and more steam lost by blowing through. The gas-works product—ammoniacal liquor—would, no doubt, work the Pulsometer as well as water; but whether the liquor would bear the steam and hot water treatment without much injury, is a matter to be considered in connection with this pump and this product.

Correspondence.

[*We do not hold ourselves responsible for the opinions expressed by Correspondents.*]

ILLUSIONS.

Sir,—"Men like to be tickled by novelties," so, without limitation, says Mr. George Anderson, in your Journal of the 6th inst. No doubt this is true of some men, but surely *all* are not so weak as to be so easily tickled or taken by novelties as to be dependent entirely upon the judgment of other men. Novelties, when (as they are sometimes) synonymous with improvements, are things to be desired, and certainly he who abstains from investigating any one which may relate specially to his own profession, contenting himself by passing it by with a sneer, takes up a position little calculated to enhance his reputation.

I admit that "illusions" are very prevalent, and none more so than one that prevails among some old gas makers of large experience—namely, that they have attained to the perfection of carbonizing, and that there is to be no more progression in that direction. I did not, however, expect to find Mr. Anderson manifesting any tendency to this "illusion;" he has lived and worked long amidst gas makers, and well knows that many things which were deemed to be "illusions" in past years are now every-day facts. Five-and-twenty years ago, or even within a later date, the exhauster itself was deemed to be an "illusion" by the greater portion of the gas world, and the individual who then dared to talk of an increased production of gas attending an exhauster's use to the extent of, not 12, but even of only 5 per cent., would have been regarded by most of his hearers, not merely as labouring under an "illusion," but most likely as almost a lunatic, and would have been met with an assertion which is implied in Mr. Anderson's letter, and which has been actually made to me:—"There is only so much gas to be got out of a ton of coals, and you can't get any more;" such assertion being based on the assumption that the "so much" ordinarily obtained must be the *maximum* quantity obtainable. With time and experience many things in the practice of gas-making have changed, and he is now regarded as under an "illusion" who, having works large enough for an exhauster's use, refrains from using one.

Mr. Anderson cannot realize that an improved system of charging and drawing may, as it does, lead to a larger yield per ton of better—or, at *least*, *equal* quality—gas, and better coke; yet curiously enough he admits, in his claim for exhausters, that the conditions under which coals are carbonized affect and modify results, which is the gist of the whole matter. Present the coals in a state more favourable for the rapid evolution of gas, charge retorts more promptly, and work off the charges in a shorter time, and most, if not all, the claims which Mr. Anderson ridicules will be borne out by results.

F. W. Hartley.

55, *Millbank Street, Westminster, London, S.W.*,
Nov. 8, 1877.

Sir,—We can very shortly dispose of Mr. George Anderson's objections to the steam-jet exhauster, mentioned in your last week's issue.

1. In consequence of his statement as to steam consumption, we asked Mr. J. W. Whitaker, manager of the Wakefield Gaslight Company, how much steam he required to work our steam-jet exhauster. His reply runs thus:—"We evaporate about one gallon of water per 1000 cubic feet of gas exhausted (being 10 gallons per ton) against about 8-inch head of water. I generally work at 50 lbs. steam pressure on the boiler. There will be about 50 or 60 feet of pipes to the exhauster, which are all lagged. I have no objection to you using my figures, which are perfectly correct, and not taken at any specially favourable time. Mr. Anderson's experience differs very much from mine."

2. The boiler, where the steam-jet exhauster is used, may be, and usually is, fed by an injector more economically than with a feed-pump, and with less deterioration to the boiler, particularly when using our new universal injector, which takes water of 155° Fahr., and forces it at about 240° Fahr. into the boiler, being about 30° above boiling point.

3. The ordinary condenser in a gas-works, as in Mr. Anderson's case, is almost always sufficient to condense the steam from the exhauster as well as the gas.

4. We have had the steam-jet exhauster working for months in a great number of gas-works without any accumulation of thick tar in the condenser.

5. There *is* a gain of at least one candle in illuminating power by the use of the steam-jet exhauster, besides other advantages which are now too well known to gas managers to require occupying your space with.

We note that Mr. Anderson requires the half of 60 gallons of water per ton to work his exhauster, or fully three times the amount required by the steam-jet.

Donát Ruben (for Körting Bros.).

17, *Lancaster Avenue, Fennel Street, Manchester*,
Nov. 9, 1877.

THE STEAM-JET EXHAUSTER.

Sir,—The paper entitled, "A Twelvemonth's Experience of the Steam-Jet Exhauster," read by Mr. Duncan Jeffrey before the West of Scotland Association of Gas Managers, and the subsequent discussion, as reported in your issue of the 23rd ult., call for a few remarks.

An exhauster that keeps working with insane zeal "where no gas is making at all," producing "explosions," and gas liquor that has to be given away for nothing, is a wondrous and fearful phenomenon.

The mechanical defects of which Mr. Jeffrey complains are so evident and simple, and at the same time so intolerable, that one would have thought that any ordinary mechanic, under Mr. Jeffrey's instructions, would have speedily set them right. Who is to blame for this Kirkintilloch *fiasco*, whether the makers of the exhauster and governor, or their agents, or the erector of the apparatus, or the manager of the works, or the men in charge of the exhauster, is a point on which the writer has at present no certain knowledge. What he and many other users well know, and what it behoves him to say, is, that the paper illustrates the abuse rather than the use of a steam-jet, and that, whatever partiality he may feel for his own child, he cannot persuade himself that a jet so abused can possibly be "a most convenient mode of producing exhaustion."

Proceeding to the discussion on the paper, I find Mr. Young falling into the same errors which were corrected in my letter to you on Dec. 21, 1875.

He does give me the credit of having been the first to introduce to the notice of the gas world a steam-jet for exhaustion; but there, on would almost suppose, from his remarks, the inventors dropped the affair, and Mr. Young "pointed out" the rest. He "pointed out" the tolerably apparent fact that the greater the velocity of the steam the greater the exhausting power. He pointed out the very apparent consequence that, therefore, there is an advantage in high velocity. He pointed out that the best way to accomplish this was to regulate the steam by a spindle working in the steam nozzle. He does not explain in what sense he can have pointed *out* things which were described, published, and practised years before he pointed *to* them. [See your number of May 23, 1871.]

He further pointed out that there was a defect in keeping the orifice through which the steam had to drive the gas, always of one particular size, although, both in the original Cleland Exhauster and in the Körting-Cleland, special means are provided to do away with this objection. He also pointed out that an arrangement could be made that, as the gas lessened in quantity, the multiple conical orifices could be brought together until they were closed, when no gas was passing through, or adjusted to the quantity being made; but he forgets, seemingly, that I pointed out and explained, in the letter already referred to, that the arrangement he proposed for that purpose was impracticable.

But the most surprising point made by Mr. Young is that, although no gas is being made, as much steam must be passing through as will overcome the back resistance of the gasholders, &c. (!) In this I observe he is echoed by Mr. Sugg, who adds this remarkable truism (an essential feature of this exhauster from its birth), that, with the increase in the quantity of gas, the velocity of the steam ought to increase, and *vice virsâ*. Is it possible that these gentlemen can have really examined a steam-jet exhauster and its connections, either in the original or improved forms, or have even carefully looked over the figures and description of either?

I certainly must give Mr. Young the credit for having pointed out "impact" as a possible, though very improbable, cause of lateral induction; but unfortunately the writer is obliged to take exception to the word "impact," as being inappropriate and misleading, when applied to the union and co-mingling, not intermittent but continuous, of two streams of gas or vapour proceeding in the same direction.

To those who have attentively read what has appeared in your columns from time to time respecting this exhauster, it will probably appear that more than enough has been written on the above points. I shall therefore at once conclude with a remark of more general interest—viz., that it would tend to increase respect for such discussions if unfounded statements were more carefully avoided.

Wm. Cleland.

Linacre, Nov. 9, 1877.

PROVISIONAL ORDERS.

Sir,—In a recent issue, Mr. W. Livesey drew the attention of non-statutory gas and water companies to the above question. In a previous communication to your paper that gentleman, in referring to the power conferred (?) upon gas companies by Provisional Orders, stated that, if the 1862 and 1867 Joint-Stock Acts did not apply to such companies, they would be in the happy position of being able to regulate their proceedings in any way they pleased, and set all statutory regulations at defiance. There appears to me to be a little inconsistency in the two letters; the latter speaks of the restrictions (paragraphs 6 and 7) which the Provisional Orders impose upon companies who are under their provisions. For instance, a Provisional Order authorizes (?) the raising and increasing of the necessary capital for the carrying on of the undertaking. What is the use of this supposed privilege? The 1862 and 1867 Joint-Stock Acts *compel* the company to register, &c., the increase of capital, also to make annual returns of members and shares, as though no statutory authority were conferred upon them by Provisional Order for that purpose. Is it to make assurance doubly sure? There cannot be any reasonable necessity for them both. Mr. Livesey also spoke of the inexpensiveness of a Provisional Order. My advice to gas companies who are in the happy state outside the pale of statutory existence is, to well consider before they incur the cost of making further sacrifices in the direction of supposed immunity from risk and annoyance.

As to cost, I have seen it mentioned in your columns, over and over again, that a Provisional Order costs only £100—a Special Act £300, if unopposed. I, too, have some experience and actual figures for my guidance, and state, unhesitatingly, that, in every case with which I am acquainted, the cost has varied from over £100 to £240 for a Provisional Order. The advantages secured by this outlay appear to me to be very vague, and most certainly incommensurate with such an expenditure. That here and there obstreperous directors are to be met with I do not deny, and that they exist in connection with undertakings other than gas and water there can be no question; but what is equally clear is the fact furnished by Mr. Livesey himself—viz., that out of 900 gas companies who should have availed themselves of the supposed

blessings which a Provisional Order is said to confer, 70 or 80 only have secured them. When we find that up to the present time only about 9 per cent., or at the rate of 1¼ per cent. per year, of the very companies for whose special behoof this parliamentary provision has been made, have placed themselves under its protection, I think we may conclude, *à priori*, that there must be something egregiously faulty in the enactment; or, on the other hand, it may be assumed that provincial capitalists have but little faith in Board of Trade law-makers, and prefer to bask in regions beyond the benign influence and control of persons with an undefinable policy. It is scarcely reasonable to suppose that the defaulting companies are wilfully blind to their own interests. The mere privilege of summarily dealing with a refractory consumer cannot soberly be put forward as an excuse for their obtaining such a power at such a price; and more especially is this apparent when we consider that such a difficulty may be me tby a refusal to supply, or by insisting upon a deposit being made as a security for future payments of gas-rents. In this respect a non-statutory company is quite as well off as one supposed to be so much better conditioned—*minus* the loss of the cost of obtaining statutory authority.

Small gas companies exist in small places or districts, and depend very much, statutory or non-statutory, upon a mutual good understanding between themselves and their customers, and, as a rule, it may be safely assumed the relationship is one of reciprocal assistance. More of this kind or mode of conducting business with larger companies, and I opine we should hear less of the *high-handed* dealing usually accorded consumers in large and populous districts. It not unfrequently happens that applicants for a supply of gas, upon entering a gas company's office, are greeted by a condescending clerk, who, looking with outstretched neck over a counter up to his chin, puts offensive questions relative to the antecedents of the would-be consumer. It would be impossible for this treatment to be dealt out in a small gas company's office, notwithstanding the existence of an unrestricted monopoly which we are told exists in such cases, the influences at work being of such an opposite character. The former, depending upon their *legal* protection, can afford (as they too often think) to disregard ordinary social and moral obligations to their customers; the latter, fully cognizant of the fact that their well-being and very existence depend upon the good-will of their *patrons*, clearly see their way to common civility, and so avoid the unpleasant and unseemly scenes sometimes peculiar to those who chuckle in being legally installed masters of the situation. It is, therefore, clear that a small gas company are far better off without a Provisional Order than with one. If they cannot afford a special Act of Parliament I would advise them to remain as they are. Assertions are not arguments, neither are they convincing unless supported by something like reason.

I pointed out the inconsistencies of the 1862 and 1867 Joint-Stock Acts and Provisional Order in my last, but Mr. Livesey simply stated that there were none, without dealing with those I named; and although that gentleman says there can be no two opinions about the matter, I submit that the existence of my letter containing facts to the contrary is pretty substantial proof that that gentleman is wrong.

W. W.

Nov. 9, 1877.

SYMES'S PROCESS FOR MANUFACTURING GAS.

Sir,—The remarks you have made in your "Circular" of this week, respecting Mr. Symes's process for manufacturing gas, induce me to request the insertion of a few words. There can be little doubt that the usual method of carbonizing coal is very wasteful, as a few minutes spent in the retort-house during the process of charging will show. Whether the results claimed for Mr. Symes's process are to be obtained remains to be proved; but, having carried out two experiments with his apparatus, I am far from satisfied. Parts there are of it which, no doubt, are ingenious; for instance, the substitute for the dip-pipe, which consists of an automatic valve working up and down a spindle, and, underneath, a bell, the edges of which are slightly sealed in water. The action of it seems perfect, and I understood it had been tried on a practical scale. I also heard of a wonderful collection of wheels, which are concealed in the washer, and are half immersed in water, the motion of the gas causing them to revolve, and so producing a disturbance on the surface of the water, over which the gas passes, and is thus deprived of its ammonia.

In the first experiment I made, the coals used were common inland, and the quantity of gas made was equal to 10,240 cubic feet per ton of coal carbonized, the illuminating power being about 12 candles. NH_3 was not present. In the second experiment, made a week later, the coals used were of the same description as those we regularly use here. In this case the quantity of gas made was the same as in the first experiment—viz., 10,240 feet per ton—the illuminating power being about 15 candles. NH_3 was, however, distinctly present by the ordinary test. This result corresponds, as regards quantity and illuminating power, as nearly as possible with what I regularly obtain in practical working of the same coals under some disadvantages; so that it is very disappointing. One thing I noticed during carbonization was, that the illuminating power kept very regular from beginning to end, although the charge was worked right off, Tar was made in both experiments, but in what quantity I had no means of ascertaining.

I regret that it was not possible to make a more exhaustive test; but with the crude apparatus employed, it partook more of the character of a laboratory experiment with regard to quantity (which we know is very misleading), than a test of what would be made in practical working.

Charles E. Botley.

Gas-Works, Wormwood Scrubs, W., Nov. 7, 1877.

A VOLUMETRIC METHOD FOR ESTIMATING SULPHUR IN COAL GAS.

Sir,—A quick and easy method of estimating the sulphuric acid in the liquid condensed by the Gas Referees apparatus has long been sought for, and has not yet been provided, unless the method I am about to describe be considered as meeting the desired end. There is a method of evaporating the liquid and weighing the dried residue; but, as will be seen, this cannot be correct, for the residue is considered and calculated as ammonic sulphate. In the scheming out of the method shortly to be described, the apparatus at present in use has been kept only in view, and there has been no intention of designing new apparatus. Before entering into a description of the proposed test, it would be well to consider the principal substances to be dealt with, and the manner in which they are obtained.

When coal gas containing sulphur (I have no experience of any other) is burned with ammonia, amongst the products of combustion will be found ammonic nitrate, nitrite, carbonate, and sulphate, with some half-burned organic matter. With the Gas Referees apparatus, the sulphate, nitrate, and nitrite are condensed apparently before reaching the top of the cylinder, as may be proved by fixing the eduction-pipe in such a manner as to give the liquid condensed therein a fall into a separate vessel, and not into the cylinder. As much sulphuric acid will be obtained in the cylinder, &c., as though the whole of the liquid condensed had been there; and the liquid condensed in the eduction-pipe, collected and treated independently, will give an almost unweighable trace of sulphuric acid. Push this experiment further by leaving off the eduction-pipe altogether. Of course, but little liquid is obtained—there is none if the gas has been burned rapidly, and the apparatus, consequently, very hot; but the ammonic salts will be condensed chiefly in the lower part of the apparatus. Now, oft-repeated experiments show that as much sulphuric acid is obtained in this manner as by the ordinary process—perhaps a trifle more; consequently, the eduction-pipe may be discarded or shortened. The old Letheby's and Wright's tests gave large quantities of liquor and low results; the Gas Referees apparatus, without eduction-pipe, gives practically no liquor and high results.

Suppose, however, the liquor obtained in the usual manner diluted with washings, and ready for estimation. Boiling will expel the ammonic carbonates, leaving the more fixed ammonia salts behind in solution with some organic matter. Then the addition of a known quantity of standard alkali (potash or soda) will, with boiling, expel the remainder of the ammonia. With standard acid, estimate the amount of alkali neutralized by acids that had been previously combined with ammonia. When, by the process of evaporation, a residue is obtained, this is calculated as ammonic sulphate.

Now, with the substitution method above suggested, the following figures were obtained, the whole of the ammonia being calculated as sulphate. The gas was burned with ammonia as usual.

Rate per Hour at which Gas was burned, in Feet.	Sulphur per 100 Cubic Feet per BaCl gravimetrically.	Sulphur per 100 C. Ft., estimated from NH_3 volumetrically.
1·000	10·16 grains.	12·48 grains.
0·680	7·41 „	9·60 „
0·625	11·53 „	14·88 „
0·625	9·33 „	13·76 „
0·625	10·43 „	14·72 „
0·528	8·51 „	12·48 „
0·470	11·53 „	17·28 „

These figures show the large quantity of nitrogen acids formed when gas is burned with ammonia, which, however, decreases with increase of gas consumed. They show also that when results are obtained by the evaporation method, the error must be considerable, for there is also some organic matter weighed. Consequently, this substitution method is of little value when the gas is burned with ammonia.

Instead of burning the gas with ammonia, put the ammonia, either as hydrate or sesqui-carbonate, in the base of the cylinder, remove the eduction-pipe entirely, or replace it with a small upright tube, about 4 or 5 inches long (this will keep the apparatus moist), and treat the washings by the method which is described above, and is called the "substitution method." Here are some figures obtained in this manner. The columns of figures are numbered 1, 2, and 3. Column 1 is the amount of sulphur per 100 cubic feet in liquor obtained with the ammonia placed in the base of the cylinder, and estimated with BaCl. Column 2 is the amount of sulphur per 100 cubic feet, estimated by the substitution method, in the same liquor as 1. Column 3 is the amount of sulphur per 100 cubic feet obtained by the Gas Referees method, with separate test burning by side of 1:—

1.	2.	3.
10·16 grains.	10·24 grains.	9·8 grains.
10·43 „	10·56 „	10·43 „
10·98 „	11·52 „	10·98 „
8·78 „	8·96 „	8·64 „
10·32 „	10·40 „	10·40 „
10·43 „	10·66 „	10·43 „

The average of a large number of tests gave the excess of sulphur per 100 cubic feet by this volumetric method, over gravimetric in the same samples of liquor, as ·2 grain—an inconsiderable quantity.

If this method be adopted with tests extending over a period of about 20 hours, the ammonia will have to be renewed once during the experiment; but if small quantities of gas are to be estimated in a short time—say 2·5 cubic feet in four hours—a small quantity of ammonia will last through the experiment, and keep the cylinder always alkaline. It is for such short tests that this method is more especially proposed. With one cubic foot, excellent results have been obtained by working on the whole quantity of washings. A convenient solution, if standard solutions are not at hand, is prepared by dissolving 414·06 grains of pure and dry sodic monocarbonate in one gallon of distilled water, or one-tenth this quantity in 1000 septems. An acid solution exactly equivalent to this should also be prepared.

If the quantity of gas burned has been 10 feet, and one-fourth of the washings estimated, then each septem will represent ·5 grain of sulphur per 100 cubic feet; or, if 2·5 feet be burned and the whole quantity treated, the same amount will be represented.

Directions for the use of these solutions are as follows:—Put the quantity of liquor to be estimated for sulphur in a beaker with 100 septems of alkali solution, then boil briskly, but in such a manner as to avoid loss, until no ammonia is evolved. This point is best determined by placing over the beaker a watch-glass, and testing the steam, that has been condensed thereon, with delicate litmus paper; then stand aside a few moments to cool a little; add some cochineal solution, and carefully run in the acid solution from a burette until acid reaction occurs. The number of septems used deducted from 100 and multiplied by ·5 will give the quantity of sulphur per 100 cubic feet. If the sulphur in

the gas is likely to be more than 50 grains, of course more alkali solution should be used. The advantages of this method for small quantities of gas, or what are called "quick tests," are obvious.

LEWIS THOMPSON WRIGHT.

23, *Sutherland Gardens, W., Oct.* 31, 1877.

NORTH OF ENGLAND GAS MANAGERS ASSOCIATION.

SIR,—Having read in the columns of the JOURNAL the report of the first meeting of the above Association, I shall feel gratified by being permitted in your next issue to congratulate Mr. Warner, the President, and the other members and associates, on the formation of their society.

I could not fail to observe that this Association is composed of "members and associates," and I thus became aware, for the first time, that, about the same time last year, he and I had been both engaged creating "associates," and that without any knowledge of each other's ideas; but with a difference—he succeeded, I failed.

This step on the part of the newly-formed Association is, I think, the most important that has been taken in connection with such societies since their earliest days; and, as the founder of the West of Scotland Association of Gas Managers, I may be allowed, through your columns, to inform the North of England members and associates of the coincidence that while they were forming themselves into an association last April, I was preparing a proposition for some slight alterations in the constitution and rules of the West of Scotland Association. Amongst others, I proposed that Rule 4 of that Association be altered to read—"This Association shall consist of ordinary, extra-ordinary, and honorary members, and associates."

My reasons for desiring the admission of associates to our meetings were various, the chief one being that if young gentlemen and others studying for, and intending to become, gas managers were allowed to attend the reading and discussion of papers, &c., they would receive all the advantages of members in becoming better acquainted with their calling, and have an opportunity of hearing and studying the various experiences of others, and thus learn how their difficulties were surmounted; thereby making them more valuable assistants, as also preparing them the better to occupy the important positions as gas managers when so appointed. I felt also that, by their having attended these meetings, and become practically acquainted by taking part in discussing gas topics, and in the general management of the society, these gentlemen would certainly hereafter prove themselves not only better managers than their forerunners, but also more useful members of the Association. I did not, at the same time, overlook the fact that by my proposal a great increase of names on the roll would occur, the funds also increasing in the same ratio. I regret that the West of Scotland Association declined, at that time, to consider my motion. It is not, however, too late for them to adopt it, and I hope yet to see that and every other gas managers association with its list of associates, and every member taking an interest in "teaching the young idea how to shoot."

The following are some of the rules, as proposed by me, and laid on the table at the meeting of the West of Scotland Association in April, 1876:—

"That this Association shall consist of ordinary, extra-ordinary, and honorary members, and of associates.

"Associates shall be assistant gas managers or engineers, and others devoting their time to the prosecution of duties in connection with gas-works undertakings, with the view of becoming managers of gas-works, and may be admitted as associates of the West of Scotland Association of Gas Managers, on being proposed and seconded, recommended by the committee, and approved of at a general meeting of members by a majority of at least three-fourths of those present. The vote to be taken by ballot.

"Associates shall have every facility afforded them for attending meetings convened for the reading and discussion of papers on gas matters, and may take part in such discussions, but shall have no vote in the management of the Association business, nor participation in the other benefits of membership.*

"An ordinary member retiring from the position of manager of a gas-works shall thereafter (unless otherwise elected) be classed as an associate.

"Associates, on becoming managers of a gas-works, shall thereafter class as members of the Association.

"If any person proposed as a member or associate, on being balloted for, be rejected, no notice shall be taken of the proposal in the minutes.

"Every Associate shall meantime contribute to the funds of the Association the sum of five shillings half yearly, payable in advance.

"Moneys received from associates shall be applicable to the Association, or to the 'benevolent-fund,' as the committee may determine."

WILLIAM KEY, Manager.

Tradeston Gas-Works, Glasgow, Nov. 8, 1877.

PORTLAND CEMENT CONCRETE.

SIR,—The subject of applying Portland cement concrete in the making of gasholder-tanks is one which, of late years, has occupied the attention of several gas engineers of high reputation; and the results of the experiments have been on the whole successful.

Although I have never built a concrete tank, I have used cement concrete for many other purposes, and this experience has proved that there are many errors we may fall into by adopting this style of building. Not that the principle is wrong, for I believe it to be the best; but there is a care required in the selection of the materials to be used in the concrete, a neglect of which will result in failure.

Concrete in itself cannot be water-tight; the nature of the materials, and the manner of bringing them together, render it impossible. If the material were finely ground, perhaps, the tank might approach tightness, but this would be done at the expense of the quality, for concrete so made is not nearly so strong as rough stone and shingle. But it is not necessary that the concrete should be water-tight; it is to the rendering suggested by Mr. Douglas we must look for making the tank water-tight. The concrete itself forms only a good backing for the rendering.

Speaking theoretically, if it were possible to construct a tank with walls of Portland cement one-half of an inch thick, and if walls so constructed were sufficiently strong to withstand the pressure from within, the tank would prove to be as water-tight as if there were any quantity of concrete behind. In practice, the concrete is necessary to counteract the pressure of the water, and to form a sufficient foundation for the guide framework of the gasholder.

Some time ago an illustration of the above came under my notice. A tank of large area, and about 9 feet deep, had been built of Portland cement concrete, and it was rendered in the *inside*, to prevent the water leaking outwards; but in the meantime, and before it was filled, the water from the springs had accumulated *outside*, and came through the concrete, forcing the rendering inwards, proving, as I think, conclusively that it is the rendering, and the rendering alone, which makes any tank water-tight.

The fact that gas-works abound in suitable material for forming concrete makes the question one of special interest and importance to gas engineers. Burnt-up retorts, old brick, clinker, and breeze are suitable for concrete, but their applicability is not fully recognized. I believe if those gas engineers who have had experience in this department would relate the same through the columns of your valuable JOURNAL, much useful information would be imparted.

JOHN M'CRAE.

Gas-Works, Bury St. Edmund's, Nov. 5, 1877.

SIR,—Having noticed for the past few issues of the JOURNAL OF GAS LIGHTING the correspondence on Concrete, and as there is evidently a wide difference of opinion as to its being porous or not, allow me to add my experience to assist in clearing off all doubts.

Under the direction of Mr. George Anderson, of London, the celebrated gas engineer, I have constructed a 60-feet holder-tank for this company, which has turned out perfectly tight. This successful issue was effected with only a slight rendering of cement plaster over the face of the concrete, some parts of which were not more than one-eighth of an inch thick. The secret lies in the proper proportion of grit and small materials employed, and the proging and ramming of each layer into a solid mass in the laying of it down.

ANDREW DONALDSON.

Gas-Works, Queenstown, Nov. 5, 1877.

IRON PEROXIDE.

SIR,—In answer to the inquiry of a gas director in your issue of the 16th ult., as to the use of ground hematite for purification, I am able to say, from experience, that it is quite useless. The peroxides, or, more precisely, the sesquioxides of iron, effective for this purpose, are hydrated. Hematite is anhydrous.

WM. CLELAND.

Linacre, Nov. 9, 1877.

Legal Intelligence.

HANLEY POLICE COURT.—MONDAY, OCT. 29.

(*Before Messrs.* GREENWOOD, ASHWORTH, *and* RIDGWAY.)

HARRISON *v.* THE STAFFORDSHIRE POTTERIES WATER-WORKS COMPANY.

The plaintiff is a colour manufacturer in Bath Street, Hanley, and the summons alleged that "a difference has arisen between the said T. W. Harrison and the Staffordshire Potteries Water-Works Company as to the liability of the said company to supply water to sixteen houses in Vale Place and Granville Street, Hanley, aforesaid, and also as to the necessity or fitness of the directions or requirements of the said company in this case." In the information, the complainant alleged that he had provided a proper pipe of sufficient strength for the purpose of conducting the water from the main-pipe of the company to the houses, and that he had affixed proper taps, stopcocks, and other apparatus to the pipe, conducting such water so as effectually to prevent the water from running to waste. The company had, however, turned off the water, although the pipe was of sufficient strength, and the proper apparatus was fixed so as to prevent waste of water.

Mr. BISHOP appeared for the complainant, and, in addressing the Bench, stated that his client was anxious to have the case tried on its merits. The houses had been supplied with water for many years, and had been the property of the complainant for about two years. There had never been any trouble about the water, of which there was always a good supply. There was a leakage in one of the pipes, and the company cut off the supply of the whole of the fourteen houses. There was a great difficulty in bringing evidence before the Court, owing to the difficulty experienced with the plumbers. A plumber knew that if he gave evidence against the company it would be worse for him. On account of this one leakage, the company wanted his client to go to an expense of £20 in putting in seven new pipes. The regulations had been altered during the last few years, and the pressure now was much less than it was then. He should contend that if repairs were done when needed, and deficient pipes replaced, all was done that was required, and it was unreasonable to expect a pipe to be taken up and one of greater weight substituted.

The company's inspector was called to ascertain where the leakages were, Mr. KNIGHT, who appeared on their behalf, stating that there were three leakages. The witness explained that he cut off the supply owing to a leakage. The leakage still existed, and as he heard a leakage near the main he cut it off close to the main, and the noise ceased.

The complainant was then called. He said he had no intimation from the company as to any leakage. He told a plumber to do all necessary repairs. The plumber said that the repairs were all done, but the company refused to allow the water to be turned on to see if it were so.

In cross-examination by Mr. KNIGHT, witness said he did not know that the pipes had been down for 40 years. His three-quarter inch pipe weighed 6 lbs. to the yard, and the half-inch 4½ lbs.

Mr. KNIGHT said that all that was required was to put in pipes of sufficient strength. The fact of a pipe being a certain size would not show its strength.

A conference took place at this stage between the legal gentlemen engaged, Mr. KNIGHT explaining that seven new pipes were not required.

Mr. *Thomas Pullen*, plumber, Newcastle, said that the pipe produced (a portion cut off from the pipe) would be strong enough to bear any pressure of water that might be put on. It would stand 70 lbs. to the inch. It did not seem much corroded, and had not probably been down for more than 8 or 10 years. He thought the corrosion was the effect of ashes. There was greater pressure when the works were first laid than now, as the demand for water was less at that time.

Mr. KNIGHT said that an enormous amount of water was wasted in the neighbourhood. The company had now got sufficient water to give the Potteries district a practically continuous supply. A hole, the size of a pin's head, would waste enough water to supply 23 families of five persons with 10 gallons per day. The company could not keep a continuous supply

* This Association has a managers benevolent-fund.

on with so large a pressure unless pipes of the proper weight were employed. He was prepared to call witnesses to show that the pipes had been down for 40 years, and were quite unsuitable.

Mr. *Harrison*, engineer of the company, said that he tested the pressure near the complainant's houses on Friday night. He found it to be 70 lbs. to 75 lbs. to the inch, and when there was a concussion by closing pipes, it would probably rise to 120 lbs. It was necessary to have pipes of sufficient strength to stand the maximum pressure.

In cross-examination he said that he did not think that half-inch pipes, 4 lbs. to the yard, would stand a 75 lbs. pressure. He certainly should not put them in at that strength.

Mr. *Wright*, engineer and manager of the Wolverhampton Water-Works Company, said that no company should send water through pipes like that. A pipe of that strength might possibly stand a heavy dead pressure, but might burst with a beating pressure of much less power. The effect of the latter would be to cause a leakage, and he had no doubt that that was how the leakage was caused. The regulations at Wolverhampton were the same as at Hanley with regard to the test strength of the pipes. He knew that some companies stipulated for 7 lbs. for half inch and 11 lbs. for the three-quarter inch pipes. He believed that this was the case at Sheffield.

Mr. BISHOP contended that the requirements of the company were not reasonable.

The CHAIRMAN (Mr. Greenwood) said that after having heard that so small a leakage would cause so great a waste, he must decide that the company's requirements must be attended to, otherwise they would, of course, be unable to supply water in the neighbourhood to the proper extent.

Mr. KNIGHT applied for costs, which were granted.

JARROW BOROUGH POLICE COURT.—THURSDAY, Nov. 8.

CONVICTION FOR STEALING GAS.

Wm. Lisle, butcher, Market Square, Jarrow, was summoned for having consumed gas in his house and shop after having had his service discontinued by the officials of the South Shields Gas Company.

It appears that on the 26th of October the gas company removed his meter and disconnected his gas service, owing to his being in arrears; but at night, and on the following night, he had his gas burning in the shop, and when the company's servants examined his pipes it was found that he had connected the service by means of a piece of india-rubber tubing.

Defendant admitted the charge, and was fined 20s. and costs, and, in addition, 5s. for each day he used the gas.

Miscellaneous News.

THE INSTITUTION OF CIVIL ENGINEERS.

The opening Meeting of the ensuing Session of this Society takes place this evening, when a Paper will be read on "The Progress of Steam Shipping during the last Quarter of a Century," by Mr. Alfred Holt, M. Inst. C.E., of Liverpool. With a view to direct the attention of members to the obligation, voluntarily incurred, of doing all in their power to further the interests of the society by presenting good papers, the council have issued, under the title of "List of Subjects for Papers," a tractate which gives some interesting information respecting the funds under their control for the award of premiums. From this it appears that between £400 and £500 is available annually for rewarding the authors of "approved original communications." The awards take the shape of Telford and Watt medals, which are the most highly prized, instruments, and richly bound books. There will also be adjudged this year the quinquennial Howard prize, of the value of about £80, "to the author of a treatise on any of the uses or properties of iron," or to "the inventor of some new and valuable process relating thereto," such author or inventor being a member or an associate of the Institution.

This manifesto will doubtless have due effect in stimulating the members to uphold the high reputation the Institution has acquired as a disseminator of professional knowledge, and will, it is hoped, result in the council being enabled to continue the publication of four volumes of "Minutes of Proceedings" annually.

In the list of subjects upon which papers are invited, we note the following:—

The Design and Construction of Masonry Dams of great Height for retaining Water in Reservoirs.

The Storeage and Filtration of Water, both Natural and Artificial.

The Constant Service of Water Supply, with special reference to its Introduction into the Metropolis, in Substitution for the Intermittent System.

The Systems of Domestic Water Supply suitable for Rainless Districts.

The Lighting of Railway Carriages.

The Various Descriptions of Pumps employed for Raising Water or Sewage, and their relative Efficiency.

The Manufacture of Mineral Oils, and the Lamps best adapted for their Consumption in Dwellings and Lighthouses.

The "Output" of Coal in the United Kingdom, as compared with that of other Countries; Illustrated by Statistics, showing where Coal is produced, where and how it is Consumed, and the relative Quantities Exported.

The Methods and Machinery Employed in Sinking and in Working Deep Coal Mines.

Electricity as applied to Lighting Purposes.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

The usual Quarterly General Meeting of the above Association was held on Thursday, the 8th inst., at the Bedford Hotel, Southampton Row, London—Mr. A. H. WOOD, of Hastings, the President, occupying the chair.

After the minutes of the last meeting had been confirmed, three new members were elected—viz., Mr. Townsend, Waltham; Mr. Gandon, Crystal Palace District Gas Company; and Mr. Webb, Egham.

The total number of members is now 40.

A paper was read by Mr. R. W. BRETT, of Hertford, on "Körting's Steam-Jet Exhauster."

A discussion followed, which was, as usual, conversational, and the merits and demerits of this method of exhaustion were thoroughly ventilated. It was a most interesting subject, and it is hoped that another member will shortly continue the question, so as to obtain more information on this late addition to gas engineering improvements.

A vote of thanks was given to Mr. Brett for his valuable paper, and a similar compliment having been paid to the President, for his ability in the chair, the meeting was brought to a conclusion.

PROPOSED PURCHASE OF THE NEWRY GAS-WORKS.—The Gas Committee of the Newry Town Commissioners have recommended the board to seek parliamentary powers in the coming session for the purchase of the gas-works of the Newry Gas Consumers Company, or to erect independent works for the good of the town.

METROPOLIS GAS SUPPLY.

Dr. Whitmore's report on the illuminating power, pressure, and quality of the coal gas consumed in the parish of Marylebone during October, supplied by The Gaslight and Coke Company:—

	Illuminating Power in Sperm Candles.			Mean Pressure in Tenths of an Inch.		Mean Quanty. of Sulphur in 100 Cu. Ft.	Mean Quanty. of Ammon. in 100 Cu. Ft.	Sulphuretted Hydrogn.
	*Mean of 25 Obser.	Highest.	Lowest.	Highest.	Lowest.	Grains.	Grains.	
Gas supplied from the Fulham works . .	16·33	16·90	15·91	21·66	8·65	16·10	0·36	No trace
Gas supplied from the Beckton and Bow works	16·34	16·90	15·71	31·41	15·65	12·96	0·46	No trace
Cannel gas supplied from the Pimlico works	20·47	21·11	19·80	20·82	12·18	15·10	0·43	No trace

Mean of daily readings of barometer . . . 29·82
" " " thermometer . . . 60·65

* Each observation consists of ten readings of the photometer, at intervals of one minute.

The mean illuminating power of the gas supplied from the Fulham works was equal to the light of 16·33 candles. It ranged between 15·91 and 16·90 candles; twice only did it fall below the standard of 16 candles. The mean amount of sulphur found in 100 cubic feet of this gas was 16 grains, and of ammonia half a grain. The mean light of the gas supplied from Beckton and Bow was equal to 16·34 candles. It ranged between 15·71 and 16·90 candles. Three times it fell below the standard. The mean quantity of sulphur found was 13 grains, and of ammonia less than half a grain. The cannel gas gave a mean light equal to 20½ candles. It ranged between 19·80 and 21·11 candles. The mean amount of sulphur found was 15 grains, and of ammonia less than half a grain. The pressure of all the three gases was good, and on no occasion was sulphuretted hydrogen detected by the ordinary tests, in either of them.

METROPOLIS WATER SUPPLY.

The Sixth Annual Report of the Local Government Board, which was referred to in the JOURNAL of the 30th ult., contains the yearly reports of Major Frank Bolton, Water Examiner, and Mr. Allen Stoneham, Government Auditor, on the water supply and the accounts of the Metropolitan Water Companies for the year 1876. These are addressed to the President of the Board, and are as follows:—

REPORT BY MAJOR FRANK BOLTON, *Water Examiner*.

4, *Broad Sanctuary, S.W., Jan.* 31, 1877.

Sir,—As Water Examiner appointed under the Metropolis Water Act, 1871, I have the honour to submit to you a report of the results of the examinations made and various duties performed by me, in connection with the water supplied to the Metropolis by the eight Metropolitan Water Companies, during the year 1876.

Acting in compliance with my instructions, I have made monthly examinations of the various Metropolitan Water-Works, and have duly reported the results of such examinations to the Local Government Board.

It is the duty of the Water Examiner under the Act of 1871 to ascertain whether or not the companies have complied with the requirements of section 4 of the Act of 1852, which enacts that "every company shall effectually filter all water supplied by them within the Metropolis for domestic purposes, before the same shall pass into the pipes for distribution."

Effectual filtration depends upon—

1. A sufficient area of properly constructed filter-beds, constantly cleaned and fresh sanded.
2. The rate of filtration being controlled, and limited to a certain speed.
3. The water delivered into the filter-beds having been previously stored in subsiding reservoirs, and the capacity of these reservoirs being such as to avoid the necessity for the intake of turbid and muddy water during the time of extraordinary and heavy floods, which tend to foul and choke the filters.

In addition to inspecting the filter-beds and reservoirs, and examining the quality of the water both at the intake and after filtration at the works, I have included in my reports the following information and particulars respecting each of the Metropolitan Water Companies:—

1. The source of supply.
2. The situation of the works.
3. Total volume which may be supplied daily, in gallons.
4. Average daily supply during the month, in gallons.
5. Per centage delivered for other than domestic purposes.
6. Number of houses supplied.
7. Number of houses on constant supply.
8. Estimated population supplied within the districts of the water companies.
9. Number of subsiding and storeage reservoirs for unfiltered water, showing the area in acres and available capacity in gallons.
10. Number of covered reservoirs for filtered water within the radius prescribed, showing the capacity in gallons.
11. Engine power, and horse power thereof.
12. Number of miles of mains in each district.
13. Number of miles of mains in the Metropolis.
14. Number of miles of streets with mains constantly charged, within the Metropolis.
15. Number of hydrants erected within the Metropolis, and number of fire-plugs.
16. Greatest lift by steam power.
17. Greatest and least head of pressure in the districts supplied.
18. Number of filter-beds, with area in acres.
19. Depth of sand and other materials composing the filter-beds.
20. Average rate of filtration per square foot of area, in gallons per hour.
21. Number of acres of filter-beds cleaned during the month.
22. Appearance of water before and after filtration.
23. Condition of samples taken daily.
24. Statement as to progress of works and alterations made by each company, and of the works that should be undertaken.
25. Analysis of the water supplied, made for the companies.
26. Analysis by Dr. Frankland, F.R.S., of the water supplied.
27. Analysis made for the Society of Medical Officers of Health.

The following are the alterations and additions made to the works of the companies during the year 1876, and the steps that have been taken by them towards providing constant supply.

1.—*The Kent Water-Works Company.*

1. *Constant Supply.*—800 additional houses were put on constant supply during the past year, making a total of 6900 in this company's district.

2. *Hydrants.*—966 additional were erected, making a total of 1096.

3. *New Engines.*—An additional 60-inch pumping-engine has been brought into use at Deptford.

2.—*The New River Company.*

1. *Constant Supply.*—About 300 additional houses were brought under constant supply, making a total of 2422.

2. *Hydrants.*—650 were added to the number, making a total of 2631.

3. *New Engines.*—The four new engines at Hornsey were erected, as well as the necessary buildings.

4. *Filter-Beds.*—Those at Hornsey were completed, comprising five beds of a joint area of 3¼ acres.

5. *Reservoirs.*—Good progress was made with the construction of the new high service reservoir on Crouch Hill, capable of holding 12 million gallons.

6. *Mains.*—Some 6 miles (out of 13 required in connection with the above) have been laid.

The company are still engaged in the sinking of a new well into the chalk formation at Turnford, to obtain at that place a fresh supply of water, by a large boring into the lower greensand.

To provide for the increasing demands of their district, the company are making several important additions to their distributory works, for the purpose of affording greater facilities to their several stations for assisting one another.

3.—*The East London Water-Works Company.*

1. *Constant Supply.*—This company have already completed the extension of the system in a large part of their district, the whole of which is being brought, section by section, under it. The addition to the number of houses during the past year has been 3156, making a total of 60,870 so supplied out of 109,375. Notice was given on the 19th of October last that the company proposed to give, on and after the dates in their notice, a constant supply of water throughout the district bounded by imaginary lines drawn along the centres of the Old Ford Road, Regent's Canal, Mile End Road, and Cambridge Road.

Sec. 1. On and after March 1, 1877, throughout that section of the above-mentioned district, bounded by imaginary lines drawn along the centres of the Old Ford Road, the Regent's Canal, Green Street, and the Cambridge Road.

Sec. 2. On and after April 1, 1877, throughout that section of the first above-mentioned district which is bounded by imaginary lines drawn along the centres of Green Street, Regent's Canal, the main line of the Great Eastern Railway, and the Cambridge Road.

Sec. 3. On and after May 1, 1877, throughout that section of the first above-mentioned district which is bounded by imaginary lines drawn along the centres of the main line of the Great Eastern Railway, the Regent's Canal, the Mile End Road, and the Cambridge Road.

The directors have decided upon making a considerable extension of their works with a view to give an increased supply to Buckhurst Hill and the adjoining districts. These works have already been commenced, and consist of a covered reservoir, new engine, and larger mains, and will be completed in the course of this year.

4.—*The Southwark and Vauxhall Water-Works Company.*

1. *Constant Supply.*—No steps have been taken at present by this company for giving a constant supply in their district.

2. *Filter-Beds.*—Owing to the inefficient state of all their filter-beds, this company undertook, during the summer of the past year, the thorough cleansing, re-construction, and putting into good condition of all the filters at the several stations; this work will occupy some six months yet to complete, and until done the filtration of the water supplied by them will not be effectual.

3. *Reservoirs.*—The covered service reservoirs at Nunhead, to contain 18 million gallons, have long since been completed, and the mains for distribution from them to the lower districts, comprising Kent Road, Bermondsey, Rotherhithe, Camberwell New Road, and Peckham, have been laid, but the present state of these new works is such that it appears they cannot be safely charged, and consequently they have not been taken into use, although most urgently needed.

The construction of further subsiding reservoirs by the Southwark and Vauxhall Company is necessary, and arrangements have been made for the acquisition of suitable ground near the intake. Without such subsiding reservoirs they cannot deliver water efficiently filtered during the prevalence of floods.

4. *Mains.*—The length of mains, constantly charged, has been considerably increased, and new ones are preparing for the better supply of Wimbledon and the neighbourhood.

5.—*The West Middlesex Water-Works Company.*

1. *Constant Supply* is being given to a number of houses on the application of the owners, and the company are fully prepared to extend the system when called upon. Nearly 700 houses were added to the number during the past year.

2. *Engines.*—The Hampton engines were enlarged.

3. *Filter-Beds.*—The new filter-bed at Barnes, of an area of 2 acres, was taken into use in September. This increase in filtering area is intended to provide for exceptional and extraordinary circumstances.

4. *Mains.*—A new 16-inch main from Barrow Hill works to Kidderpore reservoir, Finchley Road, was laid.

6.—*The Grand Junction Water-Works Company.*

1. *Constant Supply.*—No steps have as yet been taken by this company to give constant supply in their district.

2. *New Engines.*—New boilers and works at Hampton have been erected, and for this place also an additional 70-inch engine of 125-horse power has been constructed.

3. *Reservoirs.*—The company are contemplating providing additional impounding and subsiding reservoirs, which are much needed.

7.—*The Lambeth Water-Works Company.*

1. *Constant Supply.*—This company are giving constant supply, by means of stand-pipes, in a number of court and alleys. The alterations in fittings, under the Board of Trade rules and regulations, are being gradually effected as occasion offers, and are carried out in all new buildings.

2. *Engines.*—The new large pumping-engine, in course of erection at Brixton, is approaching completion, and will make the combined pumping power at this station equal to about 650-horse power, and will provide for a large extension of the country district.

3. *Reservoirs.*—The new covered reservoir at Norwood is nearly finished. This reservoir is of large capacity, and will hold 5 million gallons of water. The company will thus possess nine covered reservoirs, spread over the district between Kingston Hill and Sydenham, capable of containing altogether 29 million gallons, thus providing for the largest store of filtered water possessed by any of the London companies.

These new works will complete the series undertaken during the last four years, with the object of improving the quality of the water and increasing the quantity, to meet the present wants of the district, and the probable future requirements.

The store reservoirs and works at Molesey should now enable the company to pass through periods of heavy river floods without deterioration in the quality of the water, and these works, together with those at Ditton, and the various reservoirs and stations, are in an efficient working condition.

The recent improvements made by this company are of a very marked character, and must tend to greatly improve the present and future supply of water to their district.

When this company have extended the area of filtration (the present capacity of the filter-beds being considered insufficient for effectual filtration), they will be fully equal in efficiency to any of the water companies supplying water to the Metropolis from the River Thames.

8.—*The Chelsea Water-Works Company.*

1. *Constant Supply.*—This company give a constant supply to about 100 houses only.

2. *Reservoirs.*—The four new subsiding reservoirs are progressing, and two of them will probably be completed and taken into use about Midsummer next.

3. *The New Works*, sanctioned and undertaken in 1875, at Molesey, have been proceeded with rapidly during the past year, and the water is now taken in there instead of at Ditton, the Mole waters being thereby avoided For this purpose a new 36-inch main has been laid, and temporary pumps erected. The permanent engines and houses were completed and set to work in September.

When these improvements are completed this company will also be equal in efficiency to any of the companies drawing their supply from the Thames.

The sources of supply of the water used in the Metropolis in the districts supplied by the water companies are as follows:—

1. Kent Water-Works Company.	The chalk wells between Crayford and Deptford.
2 New River Company	The River Lea, and wells at Amwell End, Amwell Hill, and Hoddesdon; the total volume which may be taken daily being unlimited.
3. East London Company . . .	The River Lea, from which the quantity that may be abstracted daily is unlimited; and from the Thames at Sunbury, the volume to be abstracted daily at this place being limited to 10 million gallons.
4. Southwark and Vauxhall Company 5. West Middlesex Company . . 6. Grand Junction Company . .	The Thames at Hampton.
7. Lambeth Company	The Thames at Molesey.
8. Chelsea Company.	The Thames at Ditton and Molesey.

The volume which may be taken daily from the Thames is limited to 20 million gallons for each of the last five companies, and 10 million gallons for the East London Company.

The state of the water in the Thames and Lea from May to October was good, but in the other months it was generally very bad, the water taken in being muddy and turbid, consequent upon the heavy rains and floods. From an examination of the river books, kept at the intakes from the Thames, it appears that the worst flood that has occurred in that river for many years took place in December last. While these floods prevail the water companies unprovided with sufficient storeage reservoirs are compelled to take in dirty water and distribute such as they can get through their filter-beds imperfectly filtered; there is a considerable amount of solid matter in the water, and it is too fine to settle, the discoloration being caused by the chalk, clay, and other impurities carried down by the floods. This is very difficult of removal by filtration, being only practically got rid of by subsidence previous thereto.

The rate of filtration of the metropolitan water supply should not exceed 540 gallons per square yard of filter-bed each 24 hours, or 2¼ gallons per square foot per hour, and at this rate filtration should be effectual; this is greatly facilitated by previous subsidence.

The average rate of filtration per square foot of filtering area per hour for each of the seven companies is as follows:—New River, 2½; East London, 1½; Southwark, 1¼; West Middlesex, 1½; Grand Junction, 1¾; Lambeth, 3¼; and Chelsea, 1¾. The only company, therefore, that exceeds this rate of filtration is the Lambeth, and their area of filtration is about to be increased.

As the sources of the greater part of the water supply to the Metropolis are polluted, from time to time, by the prevalence of floods, it may be again advisable to draw public attention to the fact, that notwithstanding the greater care exercised by most of the companies in the storeage and filtration of the water, the organic pollution contained in the Thames water delivered in London, though subject to fluctuations from the greater or less prevalence of floods, still continues to exist. This statement clearly shows that the waters of the Thames and Lea are being deteriorated by sewage pollution, and measures should be considered to prevent as far as possible the contamination of these rivers and their tributaries, so long as they are the authorized sources of supply of the Metropolitan Water Companies, especially as the population of the country though which the Thames and Lea flow is reported to be rapidly increasing in density.

During the year 1876, I have in addition to my ordinary duties as Water Examiner, on several occasions been specially appointed to hold inquiries and report upon various matters connected with the water supply of the Metropolis, amongst which some of the most important are as follows:—

January. . .	*Athenæum Club.* Further correspondence on the subject of the supply of water by the Chelsea Company.
February . .	*Buckingham Palace.* Inquiry into and report upon the water supply. Undertaken at the request of the Board of Works.
April	*Chigwell Row.* Inquiry into the cause of deficient supply to this place in the district of the East London Water-Works Company. The *Metropolitan Board of Works* applied for and obtained various information as to areas and constant supply.
August . . .	*Nunhead.* Complaint against the Southwark and Vauxhall Water-Works Company as to short supply.
September. .	*Smoke Nuisance at Hampton*, by the Grand Junction and Southwark and Vauxhall Water-Works Companies. This matter was again brought forward and led to considerable correspondence and inquiry.

In addition to the foregoing, there were numerous applications from individuals, with various complaints, which were inquired into and reported on, and generally adjusted satisfactorily.

Since the passing of the Act of 1871, the water companies have, of their own accord, and in consequence of the recommendations of the Board of Trade and Local Government Board, incurred and undertaken a considerable expenditure. The total certified expenditure of the companies to

Dec. 31, 1876, is shown in the following statement, the total of which amounts to £11,556,843 15s. 6d.; of this £354,383 12s. 6d. has been expended during the period embraced in this report, to extend the storeage capacity of reservoirs, and increase the areas of filters, as well as to provide for the requirements of constant supply by the construction of high-service reservoirs for filtered water, and by the addition of powerful machinery to their works. These measures have, without doubt, materially improved the supply of water to the Metropolis. The extension of the constant supply system by all the companies, and the construction of additional storeage, subsiding, and impounding reservoirs by some of the companies, remains, however, to be done.

Statement of the Expenditure by the Eight Metropolitan Water Companies, on Works, Improvements, &c.

Name of Company.	Expenditure to Dec. 31, 1875.			Expended during the Year 1876.			Total Certified. Expenditure.		
	£	s.	d.	£	s.	d.	£	s.	d.
1. East London	1,898,086	12	10	15,232	19	2	1,913,319	12	0
2. West Middlesex . . .	916,695	12	9	27,208	19	2	943,904	11	11
3. Lambeth	1,215,706	6	2	66,406	12	8	1,282,112	18	10
4. Grand Junction . . .	1,190,729	2	0	*22,798	5	7	1,167,930	16	5
5. Southwark & Vauxhall	1,766,904	4	1	*24,074	17	5	1,741,829	6	8
6. New River	2,792,201	10	2	100,600	18	4	2,892,802	8	6
7. Chelsea	979,972	12	11	91,238	14	11	1,071,211	7	10
8. Kent	535,910	8	1	6,822	5	3	542,732	13	4
Totals	11,296,206	9	0	354,383	12	6	11,556,843	15	6

The two amounts marked thus (*) are those overcharged to capital, and hence deducted.

Considerable advance has been made in extending the constant supply to the Metropolis during the year just ended, notably by the East London and Kent Water Companies, and the following statement shows the number of houses to which constant supply was being given on the 31st of December, 1875, and the 31st of December, 1876, and the increase during the year.

Name of Company.	1875.	Increase.	1876.	Total No. of Houses.	Estimated Population.
Kent	6,100	800	6,900	45,432	250,000
New River.	2,122	300	2,422	125,011	900,000
East London	57,714	3,156	60,870	109,375	820,312
Southwark and Vauxhall	500	—	500	80,705	504,500
West Middlesex	624	690	1,314	48,680	365,100
Grand Junction	None.	—	None.	37,055	333,495
Lambeth	3,000	—	3,000	55,471	388,297
Chelsea	100	—	100	28,555	210,000
Totals	70,160	4,946	75,106	530,284	3,771,704

The average daily consumption during the year, for all purposes, has been 118,728,718 gallons; this gives a consumption of 31¼ gallons per head of estimated population supplied. The highest average daily supply was in July, when it rose to 137,135,102 gallons, or 36¼ gallons per head, and the lowest was in December, when it was 110,454,197 gallons, or 29¼ gallons per head.

The number of miles of streets containing mains constantly charged, and on which hydrants could at once be fixed, in each district of the Metropolis, are as follows:—Kent, 80; New River, 172; East London, 85; Southwark and Vauxhall, 100; West Middlesex, 70; Grand Junction, 41¼; Lambeth, 70; and Chelsea, 50; making a total length of 668¼, while the total number of hydrants erected thereon is at present only 4227. There has been an increase of 18 miles of mains and 1605 hydrants during the year.

The chief officer of the Metropolitan Fire Brigade reported to the Metropolitan Board of Works that the number of fires attended by the brigade during 1876 was 1632, and that the quantity of water used for extinguishing the same was rather more than 21 millions of gallons. This quantity, of which about two-fifths was taken from the street-pipes, and the remainder from the river, canals, or docks, was about double the amount raised in 1875. During the year there were 6 cases of short supply of water, 24 of late attendance of turncocks, and 10 of no attendance, making 40 cases in which the water arrangements were unsatisfactory, against 47 and 32 in the two preceding years. On inquiry from the water companies, I have ascertained that the directors generally have expressed their willingness to pay for house accommodation for the turncocks at the several fire-engine stations, if such quarters could be provided for them by the proper authorities; and had this plan been carried out during the past year, the cases in which the water arrangements were reported as unsatisfactory would probably have been reduced from 40 to 6.

The analyses of the water supplied by the water companies for 1876, as furnished by Dr. Frankland to the Local Government Board; by Dr. H. Letheby, for the first two months, to the water companies; and by Mr. C. Meymott Tidy, M.B., to the water companies and the Society of Medical Officers of Health, have been given in the monthly reports. The numbers in which these analyses are expressed differ; those of Dr. Frankland being in 100,000 parts, and those of Dr. Letheby and Mr. Tidy in 70,000 parts. or grains per gallon. [Extracts from the annual report of Dr. Frankland, which was published in the JOURNAL of May 1 last, are then given, to show the improvement made in the filtration of the water supplied during the past year.]

From the foregoing, as well as from my monthly reports, it will be seen that the Southwark, Grand Junction, Lambeth, and Chelsea Companies delivered slightly turbid water on several occasions; this is in a great measure attributable to the fact that the works of all these four companies have been, and still are, undergoing important alterations and extensions. The Lambeth and Chelsea works will probably be completed in the course of next year, when this cause of complaint should cease, while the Grand Junction and Southwark Companies require still further to extend and improve their works, in order to deliver efficiently filtered water, free from turbidity. This is especially the case with the Southwark and Vauxhall, the present arrangements of which company still remain in an unsatisfactory condition, notwithstanding that the attention of the companies must have been drawn to this subject in my annual and monthly reports for some considerable time past. (Signed) FRANK BOLTON.

REPORT BY ALLEN STONEHAM, ESQ., *on the Audit of the Accounts of the Metropolitan Water Companies during the Year* 1876.

Local Government Board, Whitehall, S.W., Dec. 31, 1876.

Sir,—I have the honour to acquaint you, that during the audits of the accounts of the Grand Junction and of the Southwark and Vauxhall Water-Works Companies for the half year ended the 31st of March last, certain circumstances came to my knowledge which led me, for a time, to withhold my certificate under section 39 of the Metropolis Water Act, 1871. The matters in dispute have been settled after long and anxious investigation, but it is desirable that the particulars of the difference should be laid before the Local Government Board.

It will be convenient at the outset to point out, that although these companies are situated, the one on the north and the other on the south side of the River Thames, they had been for many years to a great extent identified in their management. The condition, therefore, of the two companies being in this respect alike, it will be sufficient to limit my description of details to the affairs of the former company, and deal only with the results as affecting the latter.

The custom of the board of directors of the Grand Junction Company had been to order payments to be made on account of works in progress on the certificate of the engineer of the company. Every such payment was passed by me on the explicit statement of the officers of the company, that it was for new works undertaken in consequence of the growth of the district, as well as for the purpose of giving constant supply. It was further represented to me that the contracts, which were not kept at the office, would be produced on the settlement of the balance with the contractors.

As sums of considerable magnitude were in course of payment under certificates, I naturally became anxious for the production of the contracts, and on the occasion of the audit for the half year ended Sept. 30, 1875, I called upon the officers of the company to produce them, although, upon certain explanations, I assented to a compliance with this request being postponed till the following half year.

At the audit of the accounts for the half year ended March, 1876, the contracts were not produced, but a certificate granted by the superintending engineer in favour of Messrs. Harvey was produced to support a further charge against capital of £10,000, which had been made in the accounts of the company. On my firmly declining to pass this item until the contracts entered into with Messrs. Harvey were exhibited, it for the first time transpired that the so-called contracts entered into by the company had not been reduced to a proper legal form, and that the tenders for new works, properly so-called, amounted in the aggregate to a smaller sum than had been already passed, on the certificate of the engineer, as charges for new works.

After considerable delay the accounts of Messrs. Harvey were laid before me. The accounts amounted to the sum of £104,774 10s. 2d. (of which £85,000 had been paid to them), leaving an unsatisfied claim of £19,774 10s. 2d., which had been brought into charge. At this juncture, in consequence of my refusal to certify the accounts, a committee of investigation was appointed by the shareholders of the Grand Junction Company at their half-yearly meeting. This committee employed a professional accountant to investigate their affairs, but after a long and exhaustive inquiry, he discovered no irregularities beyond those which I already had under my consideration.

Having subsequently very carefully examined every item of these accounts, I felt it my duty to require that a total sum of £55,081 0s. 4d. should be make a charge against the accruing revenues of the company, by which capital would be relieved of £35,306 10s. 2d., already improperly charged thereto, and the balance of £19,774 10s. 2d., above mentioned, be at once brought into charge instead of being omitted from the account.

As regards the Southwark and Vauxhall Company, after lengthened investigation, I came to the conclusion that capital should be relieved of £33,082 8s. 8d,, and the accruing revenues be charged therewith in addition to an outstanding claim of £10,721 11s. 1d. by Messrs. Harvey being brought into charge.

Having regard to the fact that the boards of directors of both companies disclaimed any knowledge of the character of the certificates given by the engineer, I considered that I should be justified in permitting these sums to be treated as newly discovered liabilities, and that the repayment to capital out of current profit might, with propriety, be spread over a period of five years.

An objection was raised to my reopening charges which had been passed in the former accounts of the companies and already certified by me, but on my pointing out that my certificates had been obtained by the production of certificates, &c., which, had the information subsequently obtained been before me, I should not have accepted, the objection was waived, and the boards of directors of the companies expressed their acquiescence in my decision.

I should add that the engineer has himself now resigned his appointments in both companies, and that both boards of directors have been reconstituted.

Several other questions have arisen during the year in connection with my audits.

The Southwark and Vauxhall Water-Works Company many years since bought up the plant, &c., of the Richmond Water-Works Company, and the purchase-money, together with the expenditure incurred for the extension of the service, was made a charge against the capital of the former company, who thenceforth supplied that town with water. The Sanitary Authority of Richmond recently became dissatisfied with the supply, and proposed to obtain powers to undertake the work themselves, whereupon the Southwark and Vauxhall Company promoted a Bill in Parliament to confirm the powers they asserted they had obtained from the Richmond Company. They also applied to the Court of Chancery for an injunction to restrain the Sanitary Authority from their contemplated proceedings. On the hearing of the petition for an injunction it was held by the Vice-Chancellor (Sir Richard Malins) that the company in no sense represented the Richmond Water Company, and the proceedings were adjourned pending the prosecution of the Bill in Parliament. The Bill, however, was subsequently abandoned. These proceedings occasioned considerable expense, and the question arose as to the manner in which the charge should be brought into the account. The case of the Southwark and Vauxhall Water Company is a proposal to charge against revenue money expended in endeavouring to fortify a position they believed they had obtained by purchase. The money paid for the Richmond works had been included in the capital expenditure of the company, and the water-rents collected had contributed year by year to the dividends of the company. It was urged upon my consideration that the present board of directors were warranted in doing their best to protect their property at least until a court of law had decided adversely to them. After carefully weighing the arguments laid before me, I felt that I had no power to resist the charge, and that it was not desirable in the interests of the consumer that I should do so.

An examination of the works of this company appears to have convinced the directors that the filter-beds, owing either to faulty construction or to want of care in their use, or to these causes combined, are in an exceedingly unsatisfactory condition, and require re-making. This, I am informed, will involve an expenditure exceeding £10,000, but the introduction of so large a sum into immediate charge would seriously diminish the profits divisible by the company, and it would be competent to the directors to guard against a grave depression in the market value of their property by deferring the works until the funds at their disposal could better bear the

strain; but this work is undoubtedly one which, considering the quality of the water at present supplied, should, in the best interests of the consumer, be pushed forward without delay. I have expressed an opinion that the expenditure might accordingly be properly distributed over a short series of years; though, bearing in mind that revenue is now indebted to capital to the extent of £33,082, or a sum exceeding the profits of the company for one entire half year, and is also indebted in temporary loans for more than £10,000, any increase in the amount of deferred charges is so much to be deprecated that I have agreed to this concession with considerable hesitation.

As already intimated, on my refusing to certify the accounts of the Grand Junction Company, a committee of investigation, with power to engage professional assistance, was appointed. At the audit of the accounts for the half year ended Sept., 1876, it was proposed to make the expenditure incurred by this committee, amounting to £555 18s. 1d., a charge against the revenue of the company. I have carefully examined the statutes governing the company, and so far as they are concerned, can find no authority for the appointment of a committee of investigation, nor any warrant for passing the expenditure in question as a charge for the management of the company; but, admitting the expediency of allowing the charge to the extent of expenses necessarily incurred, an examination of the account in detail revealed charges relating to a contested election of directors, personal expenses of members of the committee, stamps and fees for transfer and re-transfer of shares for proxy-holding, and other charges of a questionable character. Expenditure of this nature appears to me inadmissible as a working charge against the company, and should be paid by the shareholders who authorized it, and on whose behalf it was incurred, out of their profits.

Further investigation of the accounts of the company disclosed the fact that for cerain appliances the Grand Junction Water-Works Company were paying 15 per cent. in excess of the prices paid by other companies to the manufacturers of these articles. It appears that by this means considerable overcharges were made against the company, and I have declined to regard the 15 per cent. paid in excess (amounting to nearly £400) as lost, until assured that all proper means have been exhausted in order to recover it.

In my report of last year I adverted to the practice of obtaining loans for revenue purposes, and the companies therein referred to have agreed that the interest paid for such assistance shall in future be treated as a charge to and in aid of dividend. It may, however, be well to point out that no concern can be considered as being in a sound and healthy condition until it can pay a dividend out of its realized profits, and I am glad, therefore, to have the assurances of the various boards of directors that they are making strenuous efforts to avoid a recurrence to loans of this description. But an additional pressing duty rests upon them in regard to the accumulation of a sufficient reserve of profits to provide for exceptional and unforeseen expenditure, so that the rate of dividend may not be affected by temporary causes. The general Acts, and some of the private Acts, provide that reserve-funds may be accumulated, and in well administered and prosperous companies this necessary condition is, as I have shown in previous reports, not neglected; but in less prosperous concerns the main consideration is the making of a dividend; and hence arise continual efforts to overcharge capital, and conflicts of opinion with the auditor, which, the incidence of charge being now well understood, would but seldon occur if proper reserves were maintained. For these and other reasons I was led to reconsider the practice of some of the companies (adverted to in my last report) obtaining a loan from their bankers to pay a dividend instead of collecting more quickly the water-rents due to them. Although the interest paid for such loans has been made a charge against and in aid of dividend, yet considerable sums are no doubt lost by delays in realizing the assets due, and it at one time appeared to me desirable so to vary my certificate that the payment of dividend might be made to depend on sufficient money applicable to that purpose being in the till of the company. It was pointed out to me that this course would cause some embarrassment, and as arrangements were already being made to expedite the collection of rates, I did not think it necessary to take any further steps in this direction.

(Signed) ALLEN STONEHAM,
Auditor appointed under the Metropolis Water Act, 1871.

The following are the returns of the Society of Medical Officers of Health, on the composition and quality of the metropolitan waters in October, 1877:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen. — As Nitrates, &c.	Ammonia.		Hardness (Clarke's Scale).	
				Saline.	Organic.	Before Boiling.	After Boiling.
Thames Water Companies.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	18·90	0·045	0·090	0·000	0·007	12·6	3·3
West Middlesex	19·00	0·043	0·090	0·000	0·008	13·7	3·3
Southwark and Vauxhall	19·50	0·058	0·097	0·002	0·010	13·7	3·7
Chelsea	18·10	0·054	0·165	0·002	0·009	13·2	3·7
Lambeth	20·40	0·047	0·135	0·000	0·009	14·8	3·3
Other Companies.							
Kent	26·10	0·010	0·285	0·000	0·004	20·0	5·1
New River	17·40	0·018	0·109	0·000	0·007	12·6	2·8
East London	19·60	0·040	0·099	0·000	0·007	14·3	3·3

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was very slightly turbid, namely:—Lambeth, Southwark and Vauxhall, and Grand Junction.

C. MEYMOTT TIDY, M.B.

Dr. Whitmore's report on the composition of Thames companies and other waters supplied to Marylebone during October:—

	In Grains, per Gallon.			In Parts, per Million.		In Degrees.	
	Total Solid Matter.	Loss by Incineration.*	Chlorine.	Free Ammonia.	Albumenoid Ammonia.	Hardness.	Hardness after boiling Fifteen Minutes.
West Middlesex	20·00	0·88	1·14	0·01	0·07	13·5	2·7
Grand Junction	20·08	0·85	1·16	0·01	0·06	13·6	2·7

* The loss by incineration represents the amount of organic and other volatile matters contained in the Imperial gallon (70,000 grains) of water. The total solid matter, *minus* such loss, consisted principally of carbonate of lime, with small quantities of other equally harmless salts.

The water of both companies, as seen through a glass tube 2 feet in length, was perfectly bright, well filtered, and nearly colourless. The water taken direct from the River Thames at Hampton was slightly opaque, but of average clearness and purity.

THE LATE MONS. VINCENT DU BOCHET.

The last number of the *Journal des Usines à Gaz* contains a biographical notice of the above gentleman, by M. Servier, from which we extract the following particulars:—

M. Vincent du Bochet, the late esteemed President of the Board of Direction of the Paris Gas Company, whose death took place in October last at the advanced age of 84, was gifted with such rare administrative ability and capacity for work, that a short sketch of his life may not be out of place, as showing to what position the exercise of these qualities may conduct a man.

M. Du Bochet was born at Chailly, in Switzerland, on the 31st of March, 1793. While quite young he lost both his parents, and was brought up by an elder brother, some 20 years his senior, who held a judicial appointment at Lausanne. Here Vincent remained until he had nearly attained his majority, when, following the example of many of his compatriots, he set out for Paris. Thanks to letters of recommendation, of which he was the bearer, he obtained an appointment in the banking-house of M. Vassal, where he remained 18 years. M. Vassal was not slow in discovering Vincent's aptitude for business, and first of all made him his secretary, and subsequently his confidential agent; when, in his capacity of President of the Tribunal of Commerce of the Seine, and member of the Corps Législatif, he had to devote his time to the political struggles of the last years of the Restoration. In 1831 M. Vassal died, and Vincent du Bochet was charged with the administration of his estate.

At that time several wealthy capitalists, confident in his experience and soundness of judgment, offered him the necessary pecuniary assistance for engaging in commercial affairs, and with the help of Pauwels, the engineer, he started one of the first gas-works in Paris, as well as those at St. Germain.

Business, however, did not exclusively occupy his attention. He had taken part in the great political movement of 1830, and his nephew, Jacques du Bochet, having been one of the founders of the *National*, in conjunction with Armand Carrel, Thiers, and Mignet, Vincent was honoured with their friendship. As a naturalized Frenchman he was made captain, and afterwards *chef de bataillon* of the third legion of the National Guard.

In 1846, when the creation of the great railway lines was determined upon, Du Bochet was connected with the company who obtained the concession of the Eastern line, and he took a very active part in drawing up and discussing the first contracts with the State. He was also appointed to arrange with the several States of the Germanic Confederation the junctions of the Eastern with the German lines. Two years later he assisted in the establishment of the Comptoir National d'Escompte, which was then, and is now, so eminently serviceable to the commerce of Paris. He also took part in the formation of the Italian Crédit Mobilier and the Neapolitan Gas Company, and co-operated in the opening up and working of several coal mines.

In 1855 the contracts existing between the Municipality of Paris and the several companies at that time supplying the city with gas were drawing to a close. It then became a question with the directors how to preserve their shareholders interests while giving due consideration to those of the Municipality, and Du Bochet put forward the scheme of amalgamation which, with the concurrence of the MM. Pereire, resulted in the creation of the Paris Gas Company, of which he was one of the first directors, being subsequently elected president of the board. He devoted the whole of his attention to ensuring the prosperity of this great company, whose field of operations was considerably enlarged upon the annexation of the suburban districts of Paris. The lighting contracts were revised in 1861, and again in 1870, Du Bochet conducting all the negotiations with the representatives of the city. It was in the contract of 1870 that the novel principle was conceded of allowing the Municipality to participate in the company's profits.

With advancing age M. Du Bochet felt the need of rest, and after several journeys into Switzerland, he selected a charming spot overlooking the Lake of Geneva, where he was fond of passing a few months in retirement. But his activity pursued him everywhere; and not satisfied with building his magnificent house, he had erected, under his own superintendence, a group of 20 villas, to the minutest details of which he, at fourscore years of age, gave his personal attention.

Having originally taken part in projecting and carrying out the Western Railway of Switzerland, he had for several years been actively engaged in the organization of a new international railway company, for uniting the lines of France, Western Switzerland, and Italy, by means of the Simplon Tunnel, and was on the very threshold of success when he was suddenly snatched away. Up to almost his last moments his powers had never failed him, and he quitted this life in the full possession of his faculties.

The funeral took place on the 26th of October, at the cemetery of Père-Lachaise, and, notwithstanding very unfavourable weather, was attended by a large number of persons, among whom were many notabilities in the financial, commercial, political, and literary worlds. The officers and servants of the Paris Gas Company, the Comptoir d'Escompte, the Eastern Railway, and the editorial staff of the *XIX Siècle* followed the body to its last resting-place.

EXPLOSIONS OF GAS.—On Wednesday afternoon last an explosion of gas occurred at the residence of Mr. John Hodson, builder and brickmaker, 105, Tyrwhitt Road, St. John's, New Cross, London, by which nine persons were seriously injured. Two men in the employ of a gas-fitter were engaged in connecting the gas with the main, and for that purpose had to knock a hole from the coal cellar under the steps to the front entrance. A man got in the hole, and becoming overpowered by the escape of gas he called for assistance. His fellow-workman also partly crawled into the aperture, when he became insensible. One of Mr. Hodson's servants called to some workmen engaged in a carpenter's shop opposite, and they managed to rescue one of the men. They then enlarged the hole to endeavour to get the other man out. The gas at this time was escaping from the pipe, and shortly afterwards a tremendous explosion occurred, shattering the windows and ceilings. One of the windows was blown a distance of over 50 feet. Several persons were more or less injured, and the interior of the house, which contains 13 rooms, was seriously damaged, especially the front part.—An explosion of gas also occurred at Great Grimsby, on the same day. On coming down stairs in the morning, the occupier of a house in Orwell Street found that an escape of gas had taken place during the night, and he thoughtlessly struck a match. The consequence was that a terrific explosion immediately took place, and such was the force that nearly all the windows in the house were blown out, and fragments of glass were carried right across the road. The furniture was damaged, though not to a very great extent. The back windows of the adjoining houses were also broken. The man was somewhat seriously burnt about the head and face, and medical aid had to be called in.

SALFORD CORPORATION GAS SUPPLY.

Annual Report of the General Gas Committee.

The Gas Committee present the usual statement and report on their department, for the year ending June 30, 1877:—

—	Made in Cubic Feet.	Sold and Used in Cubic Feet, and Balance of Stock.	Leakage in Cubic Feet.	Leakage per Cent. on Make.
Quantity of gas this year. .	623,406,000	538,322,311	85,083,689	13·61
Ditto last year	583,470,000	501,805,838	81,664,162	13·99
Increase.	39,936,000	36,516,473	..	..
Increase per cent.. . .	6·41	6·79	..	..

The average illuminating power of the gas, as tested by Dr. Angus Smith, has been equal to 19·02 standard sperm candles.

—	Within the Borough.	Outside the Borough.	Total.
The rental from—	£ s. d.	£ s. d.	£ s. d.
Private consumers, for gas . . .	77,405 10 10	21,780 19 2	99,186 10 0
Meter-rents	2,077 3 6	375 18 9	2,453 2 3
Public lamps	6,682 12 7	1,034 10 1	9,717 2 8
	88,165 6 11	23,191 8 0	111,356 14 11
Last year	81,415 12 2	22,139 8 1	103,555 0 3
Increase	6,749 14 0	1,051 19 11	7,801 14 8

—	This Year.	Last Year.	Increase.	Increase per Cent.
The number of hired meters in use.	14,754	14,149	585	3·97
Ditto consumers own meters . .	9,275	9,069	206	2·22
Total number of consumers . . .	24,009	23,218	791	3·29
Ditto public lamps	5,332	4,984	348	6·52
Ditto consumers and public lamps.	29,341	28,202	1139	3·88
The number of new and additional service-pipes laid to private consumers	1,853	1,965	..	..
The number of new and additional lamp services . . .	281	324	..	..

During the past year your committee have laid 17,159 yards of new mains, 5981 yards of which replaced others of less dimensions. A summary of the same is appended.

The gross profit of the past year is £52,755 14s. 1d., compared with £22,218 10s. 11d. in the preceding year, and it is appropriated as follows:—

To Interest on mortgage debt	£11,487 14 11	
Sinking-fund	6,302 16 6	
Annuity to the Salford district	2,530 0 0	
Depreciation-fund general account, at 3 per cent. .	9,207 9 0	
Depreciation-fund hired meters account, at 5 per cent.	1,097 18 9	
Arrears of contributions to the depreciation-funds for the year ending 1875—		
General account, at 1 per ct. £2100 11 0		
Ditto ditto, 1876, at 3 per ct. 8898 0 0		
	£10,998 11 0	
Hired meters account, 1875–76 . . .	1,531 11 8	
	12,530 2 8	
	£43,156 1 10	
The remainder constitutes the divisible profits, and amounts to the sum of £9599 12s. 3d., which has been apportioned as follows, proportionately with the consumption of gas in each district:—		
To the Salford district £5349 2 9		
„ Pendleton district 2250 4 3		
„ Broughton district. 2000 5 3		
	£9,599 12 3	
	£52,755 14 1	

The alterations and extensions foreshadowed in the last report of your committee, and which were subsequently approved by the council, and ordered to be carried out, are making satisfactory progress; and a small portion of the same is nearly ready for work.

The profits of the past year are considered satisfactory. In anticipation of the same, your committee were enabled to reduce the price of gas for the current year.

William Sharp, Chairman.

Gas-Works, Salford, Sept. 27, 1877.

Appendix.

Main-Pipes Laid and Taken Up for the Year ending June 30, 1877.

—	2 In.	3 In.	4 In.	5 In.	6 In.	8 In.	10 In.	Total Yards.
Laid In								
Salford	778	1810	625	135	357	..	46	3751
Pendleton	632	1491	733	104	536	..	..	3490
Broughton	701	1469	480	759	811	900	..	5120
	2111	4770	1838	998	1698	900	46	12361
Outside the Borough. . . .	364	769	962	1138	1565	..	..	4798
Total yards.	2475	5539	2800	2136	3263	900	46	17159
Taken Up during the Year.								
Salford	..	226	8	135	..	..	..	369
Pendleton	..	105	..	..	102	..	..	207
Broughton	..	154	53	126	811	817	..	1961
	..	485	61	261	913	817	..	2537
Outside the Borough . . .	..	81	660	1138	1565	..	..	3444
Total yards.	..	566	721	1399	2478	817	..	5981

Samuel Hunter, Assoc. Inst. C.E., Engineer and Manager.

Gas-Works, Salford, Sept. 27, 1877.

AMALGAMATION OF THE MELBOURNE GAS COMPANIES.

On the 13th of August last the shareholders in the three gas companies supplying the City of Melbourne met, each in its corporate capacity, to consider the question of the advisability of amalgamating the respective interests. The three companies are the City of Melbourne Gas and Coke Company, the South Melbourne Gas Company, and the Collingwood, Fitzroy, and District Gas and Coke Company. In each of the meetings the formal resolutions for effecting the amalgamation were carried unanimously.

The terms of agreement are set out in full in the *Melbourne Argus*. The amalgamation, provided that an Act of Parliament sanctioning the same be obtained, is to take effect on the 1st of January next, from which date the three companies will form one united corporation, to be called "The Metropolitan Gas Company." The undertakings of the respective companies, and all their property and estate, will vest in the united company, their several stocks of coal, coke, &c., being valued by a committee of the respective boards, and taken over by the united company at such valuation. All amounts which may appear at the credit of the working, or profit and loss account of the respective companies, on Dec. 31, 1877, after such accounts shall have been previously submitted to and approved of by the committee, to be regarded as available for dividend to the shareholders in the respective companies to whom such credit may belong, but no dividend is to be declared or divided on profits earned after Dec. 31, 1877, by any of the respective companies, which profits are to pass to the united company, but each company is to pay all debts (other than certain mortgages, bonds, and debentures mentioned), due by them respectively on Dec. 31, 1877, including the proportion of current interest on such mortgages, bonds, or debentures calculated up to the same date.

The capital of the Metropolitan Company will consist of the sum of £555,000, divided into 111,000 shares of £5 each, with power to increase such capital to the sum of £1,000,000, in shares of the same amount, or such other sum as the Legislature shall sanction, and the shares and capital stock of the respective companies will be merged in the capital of the united company. Of this capital of £555,000, the shareholders in the City of Melbourne Company will be entitled to £315,000 (63,000 shares of £5 each) in lieu of the shares then held by such shareholders in the capital of the City Company, but so that the proportion of shareholders of £10 shares in the City Company is to be double that of shareholders of £5 shares in such company. The shareholders in the South Melbourne Company will be entitled to £65,000 (13,000 shares of £5 each), and the shareholders in the Collingwood Company will be entitled to £175,000 (35,000 shares of £5 each).

The mortgages, bonds, and debentures of the present companies which may be in existence at the time of the amalgamation, with the interest accruing thereon, will be taken to and borne by the united company. From a schedule to the agreement, it appears that these liabilities are as follows:—

City of Melbourne Company.

300 debentures of £100 each (5 per cent. interest) falling due July 2, 1884 . . . . . £30,000

South Melbourne Company.

320 mortgages of £100 each (7 per cent. interest) due June 8, 1897 32,000

Collingwood Company.

110 bonds of £100 each (6 per cent. interest) due Oct. 1, 1883 .
95 bonds of £100 each (5 per cent. interest) due Jan. 1, 1897 . } 50,000
295 bonds of £100 each (5 per cent. interest) due Jan. 1, 1901 .

£112,000

The directors of the respective companies will be the first directors of the united company, and remain so until the first subsequent general meeting of shareholders, which is to be held within two months of the Act coming into operation, when nine members of the retiring board will be re-elected.

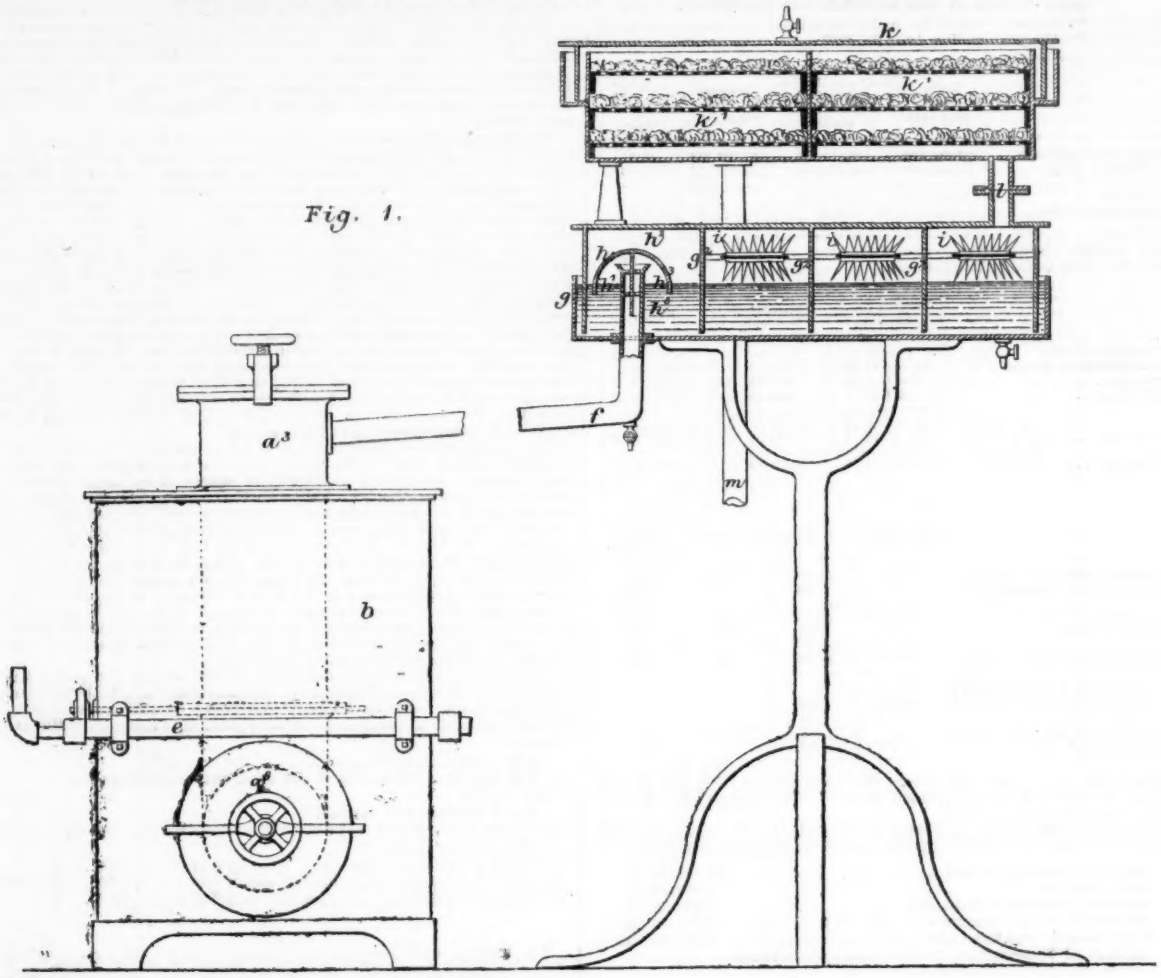
The scheme contains a number of provisions for the internal regulation of the united company similar in character to those usually adopted in English companies, and which, therefore, need not be specified.

In the interests of the public the 31st section of the scheme makes the following provision:—"The boards of directors of the respective companies to submit without delay this agreement for approval by their respective proprietors, and with a view of obtaining their consent to an application to Parliament for an Act of Amalgamation, and for repealing or altering the existing Acts of the respective companies so far as may be necessary, and for obtaining such powers and provisions as such boards of directors shall, subject to the approval of Parliament, in their discretion think proper; and for giving power to any Metropolitan Board of Works which may hereafter be constituted to purchase the undertaking and property of the united company; and for protecting the interests of the public by providing that the maximum price of gas is not to exceed 7s. 6d. per 1000 cubic feet whilst the price of coal, other than cannel coal, delivered at the works of the company shall not exceed 30s. per ton; also that the quality be such as to produce from an Argand burner, having 15 holes and a 7-inch chimney, consuming 5 cubic feet of gas per hour, a light equal in intensity to the light produced by 14 sperm candles of six to the pound, burning 120 grains per hour; also as to the amount of pressure under which gas is to be supplied; also making provision for the appointment of gas examiners and meter inspectors; also to regulate the maximum rate of dividend to be paid by the united company after providing for reproduction, and a reserve or insurance fund; and for raising further capital by the issue of additional shares, but not exceeding altogether £1,000,000 sterling; and for borrowing money on debentures to an amount not exceeding in the whole the amount of the capital then actually paid up; and for providing for the auditing of the books and accounts of the united company; and for conferring on the united company such powers as such respective boards may deem it expedient to apply for in order to give full effect to the amalgamation and carrying out the terms of the arrangement proposed hereby. The costs and expenses of, and incidental to, the promotion of a Bill in Parliament for the purposes aforesaid and incidental thereto, in the event of its passing, to be paid by the united company; but if such Act be not obtained, then all costs and expenses incurred to be borne and paid by the respective companies in proportion to the capital expended by each company respectively."

Reductions in the Price of Gas.—The directors of the Derby Gas Company, at their meeting on Tuesday last, resolved that the charge for the public lamps be 11s. 11d. for each lamp burning 1000 hours, instead of 12s. 4d., as heretofore; that the price of gas supplied to private consumers be reduced by 2d. per 1000 cubic feet; and that a reduction of, at least, 3d. per 1000 be made to the consumers in the outlying districts. These rates will take effect from the 31st of December prox. on all gas consumed after that day. At the meeting of the Lincoln City Council on the 6th inst., a letter was read from the gas company, notifying a reduction in the price of gas from 3s. 9d. to 3s. per 1000 feet, the corporation to use burners in the public lamps which would admit of 5 feet of gas per hour being burned, instead of 4 feet as at present.

SYMES'S APPARATUS FOR MANUFACTURING, PURIFYING, AND ECONOMIZING GAS.

Fig. 1.



On the 18th ult. a company was registered, under the Joint-Stock Companies Act, entitled the "Pure Carbon Gas Company," with a nominal capital of £50,000, in 10,000 shares of £5 each. The object of the company, we are told, is to purchase and work an invention patented by Mr. George Symes, of Stepney, on Nov. 22, 1876, for "Improvements in apparatus for manufacturing, purifying, and economizing gas, parts of which improvements are applicable for other purposes."

On the 3rd inst., "A Practical Demonstration of the Economic Production, Superior Illuminating Power, and Sanitary Advantages attainable under the above Important Process" was furnished by the company at the Collinge Engineering Works, Westminster Bridge Road, London, and in the "Circular to Gas Companies," on the 6th, we stated what impression this "demonstration" had made upon our minds.

We now proceed, with the aid of the specification of the patent, to describe more at length the nature of the apparatus, and the *modus operandi* of the process. The engravings, figs. 1 and 2, show an elevation, partly in section, of the apparatus.

It consists of a vertical iron retort, a, set in a furnace, b, which retort is formed in two parts. The upper part, a_1, projects through the top of the furnace, its mouthpiece, a_3, being provided with a lid or cover, a_4. The lower part of the retort, a_2, is connected by a flange joint, a_5 a_5, with the upper part, and between the two a door, a_6, is placed, which is arranged to turn upon a pivot or spindle, a_7, so as to isolate the two parts when desired. Fig. 2 is a vertical central section of the retort, by which it will be seen that the lower part, a_2, is half round or elbow-shaped, and projects through the front or side of the furnace, b, being provided with a suitable lid or door, a_8.

The door between the two portions of the retort being closed, the upper part is charged or filled with coal, or other substance, to be operated upon through its mouthpiece. When the process of carbonization is complete, the door is opened, and the coke is discharged into the lower part of the retort, where it is allowed to remain until it is partially cooled, the upper part being, meanwhile, recharged for the purpose of continuing the gas-making process. The coke is afterwards removed through the opening at a_8. The lid or cover of the mouthpiece, a_4, is provided with a series of perforated or slotted plates, a_9, placed one above another. These perforations are burred—that is to say, they are formed by punching up the metal of the plates in such a manner as to make it project from the holes on the under side of the plates. These plates serve the purpose of retaining the tar which rises from the retort, and which, instead of passing away through the ascension-pipe, is returned to the retort and burned, or "regenerated" therein.

From the retort the gas is conveyed into the hydraulic main, g, by means of the pipe, f, which, for some distance from the mouthpiece, a_3, runs in a direction slightly inclined from the horizontal, and is then extended in a vertical position through the bottom of the hydraulic, and above the water in the same. The upper end of this pipe is provided with a cup-shaped valve, h, which is placed in an inverted position, its mouth or opening, h_1, being below the surface of the water in the hydraulic. This valve has a central rod, h_2, fitted to slide in suitable guides, h_3. The valve is raised by the pressure of the gas, and allows the same to enter the main from the eduction-pipe, but prevents any back action or return of gas from the main. The specification states that "it also prevents the entrance of any impurities into the main, except a small quantity of sulphur, which is removed by the purifiers."

Fig. 2.

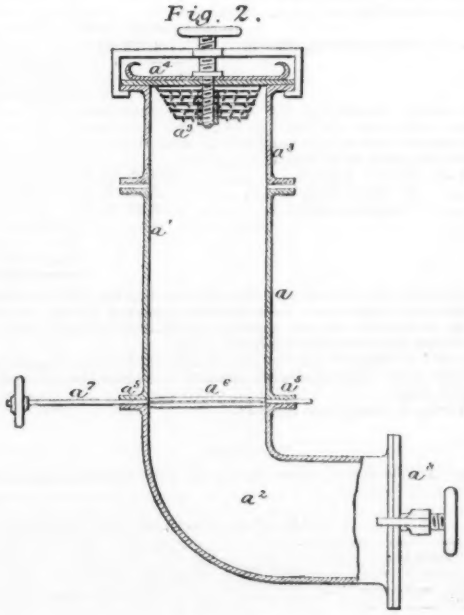


Fig. 3.

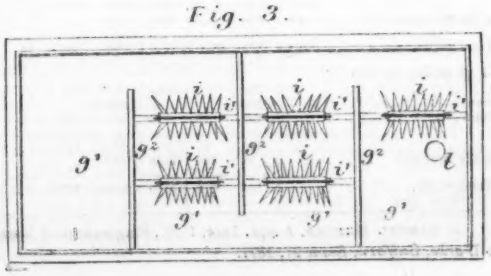


Fig. 4.

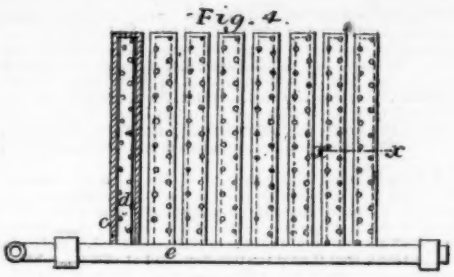


Fig. 5.

Fig. 6

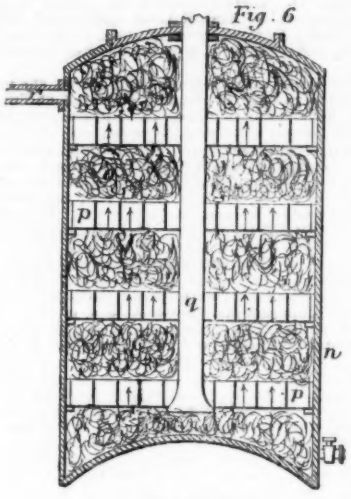


Fig. 7.

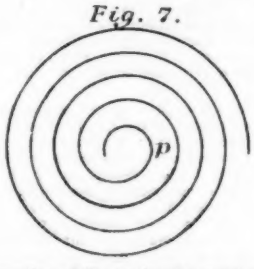
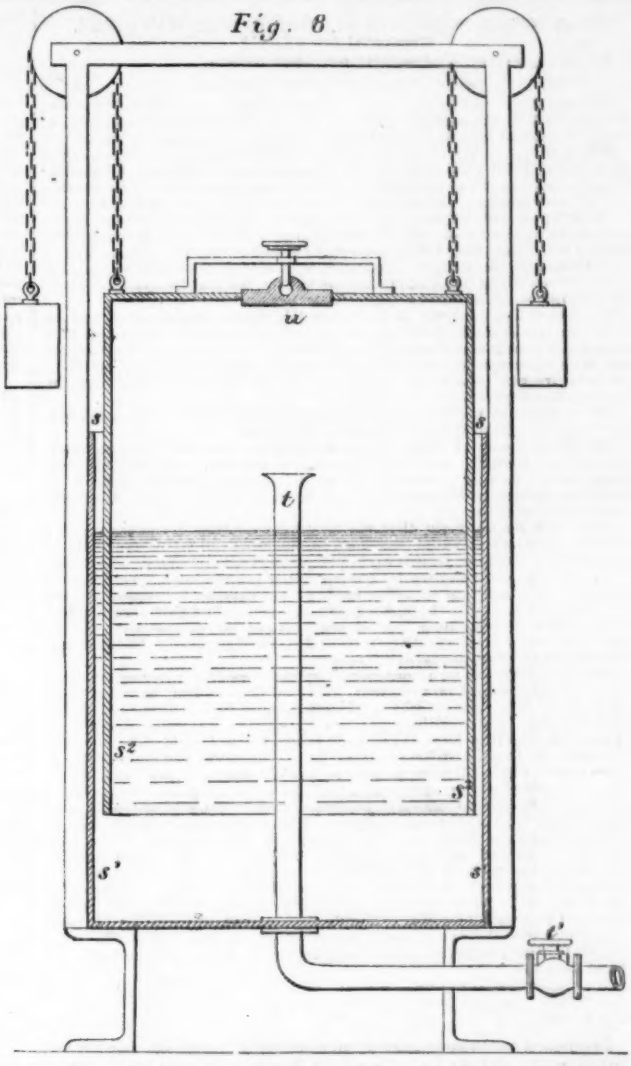


Fig. 8



The upper portion of the hydraulic main is divided into chambers by transverse partitions, g_1. Each of the chambers so formed may be connected to a retort by a separate tube provided with a valve. The inventor states that these partitions "obstruct the passage of the gas through the main, and free it from sulphurous vapour." He also "further obstructs the passage of the gas through the main for the same purpose, by providing the lid or cover of the main (fig. 3) with small metal arms or bars, i, radiating from rods or spindles, i_1, attached to the cover."

From the hydraulic main the gas ascends by the pipe, l, into the purifier, k, which is fitted with sieves, k_1, containing lime, after passing through which it is carried off at the bottom of the pipe, m.

The invention also comprises a novel form of fire-bars for use with the gas apparatus, shown in plan, fig. 4, in transverse section, on the line, $x\,x$, and on an enlarged scale, fig. 5. These bars consist of outer hollow perforated tubes, c, and inner perforated tubes, d, placed centrally within the outer tubes. The inner tubes are all connected with a pipe, e, which is supplied with water, steam, or other fluid. The inner tubes are perforated along the top, or otherwise, so that the water or other fluid issuing from the perforations keeps the outer tubes cool, and preserves them from rapid oxidation by the heat. The outer bars have perforations along one or both sides, or on the top, and the fluid issuing from these perforations in the form of spray, steam, or vapour into the fire greatly improves and economizes the combustion of fuel on the bars.

Fig. 6 shows what the inventor denominates a carbonizer or carburetter, the object of which he states to be "to resist the heavy pressure of large gasholders, and destroy the sulphurous acids, thus purifying the gas and enriching it with carbon." It consists of a cylindrical vessel, n, packed with cotton or other absorbent material, o, saturated with petroleum or other hydrocarbon liquid. Between the layers of absorbent material are placed chambers or partitions, p, consisting of a spiral plate, as shown in fig. 7. The gas enters the carburetter from the top through the pipe, q, which pipe extends nearly to the bottom of the vessel. From the lower end of the pipe the gas passes up through the absorbent material to the outlet, r.

Fig. 8 is a vertical central section of an air-forcing apparatus, which is, or may be, connected with the carburetter. It is somewhat similar to an ordinary gasholder—*i.e.*, it consists of an outer cylinder, s_1, containing water, and an inner cylinder, s_2, placed in an inverted position in the water, and supplied with air. The air-pipe, t, between this vessel and the carburetter, extends up inside the inner cylinder, its mouth being always above the top of the water. The inner cylinder, by its weight or pressure, forces the air through the pipe into the carburetter, and, "being impregnated with the vapour of the hydrocarbon which it there absorbs, mixes with the gas, and the mingled air and gas passes through the outlet to the burners. A lid or valve, u, is provided on the top of the inner vessel, by opening which, the latter may be filled with air by the action of raising it above the water in the outer vessel. The passage of the air into the carburetter is regulated by a valve or cock, t_1. "This apparatus," it is stated, "may be used in gas-works for forcing air, and reducing the richness of the gas, and increasing the quantity or volume of the same."

Wolverhampton Water Supply.—The Water-Works Committee of the Corporation of Wolverhampton, in their annual report to the council on Friday, Nov. 2, stated that during the past year the water-mains have been considerably extended, 1236 new premises have been laid on, and there has been a net increase of income in respect of them of £978 per annum. The daily average of water consumed in the entire district has been 1,955,576 gallons, of which the township of Bilston consumed 354,659 gallons per day. The boring at Cosford has been steadily proceeded with, and a report from Mr. H. J. Marten, C.E., the engineer of the works, states that the total depth now penetrated by the bore-hole is 831 feet below the surface of the ground, consisting of 478 feet of 24-inch hole, and 353 feet of 15-inch pilot hole in advance. The depth penetrated during the year has been 425 feet. Mr. Marten details the various strata passed through as the boring proceeded, and states that they are now in the hard pebbly *breccia* or conglomerate which forms the base of the pebble bed formation, and which immediately overlies the lower soft red rocks into which it is the object to penetrate. These lower soft red rocks present a very large surface area for the percolation of rainfall, and they are believed to be full of water, because copious springs of very fine quality continually discharge themselves from the outcrops of these rocks into the adjacent valleys. It is also believed, from levels which have been carefully taken, that the water in these rocks under Cosford has a considerable artesian force, and the object in view in penetrating to them is to liberate the water locked up in them, which can only reach the engines at Cosford through the opening made into them by the bore-hole. The thickness of the very hard *breccia* or conglomerate rock overlying these lower soft red rocks is usually from three to nine feet. At Cosford, however, it has proved so much thicker than usual, that the boring has now penetrated into it for a distance of between 90 and 100 feet, and under the circumstances it is a matter of considerable uncertainty as to what its thickness may ultimately prove to be. At Searle, in Lincolnshire, when rocks of a description similar to the low soft red sandstone rocks were met with at a depth of 950 feet from the surface of the ground, a spring was tapped of such artesian force that the water rose upwards of 50 feet above the surface, coming out of the ground with a pressure of something like 22 lbs. to the square inch. From the nature of the circumstances met with in the bore-hole at Cosford it is necessarily a speculation as to whether a large accession of water will result from penetrating below the impervious *breccia*. In the event, however, of an accession being so obtained of an artesian force sufficient to deliver it naturally to the present main-pipes without lowering their level, and in volume equal to requirements, a very great boon will have been secured to the town at comparatively little cost. In the event, however, of no great accession of water resulting on penetrating into the lower soft red rocks in prosecuting this further search, there will not have been any appreciable extra outlay, considering the total capital involved in the undertaking. The water from the bore-hole still maintains the remarkably fine qualities which at first characterized it, and it has been of great service during the past year in improving the quality pumped from Cosford when the river was much discoloured from floods and freshets.

WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS.

(*Concluded from p. 721.*)

Mr. HENRY AITKEN next read the following paper on

THE AITKEN AND YOUNG PROCESS.

I promised your secretary a paper for this meeting on "The Influence of Aqueous Vapours on Illuminating Gas," but since making that promise I have not found time to finish the necessary experiments then begun.

You will have seen in the JOURNAL OF GAS LIGHTING for this week a most able and elaborate paper by M. Brémond, on the influence of aqueous vapours settling down naphthaline from illuminating gas. The results got by him differ to a certain extent from those got by me, no doubt owing to the difference in the character of the gas worked upon. I will not, however, enter upon this question at present, but proceed to open the discussion on the Aitken and Young process, as mentioned in the programme.

At Hamilton, the analyzer is continuing to give perfect satisfaction, and the convener of the Gas Committee has written me that he considers they are effecting a saving of something like 20 per cent.

The size of the analyzer at Hamilton has been complained of, and no doubt the size is considerable for the amount of gas made; but when it is considered that it is not a costly erection, and that it requires no repair and little attention, it has much in its favour. We have other methods whereby we can reduce the size to a very great extent, which would possibly be adopted for large works.

The analyzer at the Glasgow Corporation works is not yet completed, but I expect to have it in operation in a few days.

The whole theory of the process is keeping the tars and gases as much separate as possible, or if they do come in contact, it is only at such temperatures as will prevent the heavy tars from carrying down with them the lighter hydrocarbons, which form, to a great extent, the light-giving portion of the gas.

There can be no doubt that the light hydrocarbons in the tar are of a similar character to those you keep in the gases; and you have only to take some of your tar, heat it up to 212°, collect the products of distillation, and then allow the tar to remain till it is quite cold, spread it over shavings, or something of a like kind, to get surface to expose the tar on, and then pass gas through among the tar, to find that your gas has been robbed of something like 30 per cent. of its illuminating power. Distil this tar as on the first occasion, and you will get nearly the same products as by the first partial distillation.

The great object to be accomplished by the Scotch gas managers is to make, at the cheapest possible rate, gas of an illuminating power of 25 to 28 candles. They can get plenty of materials in this country at a cheap rate, that can, by the ordinary process of condensation, make gas of 20 to 21 candles; but they have to pay high prices for materials that will give them the additional 5 or 6 candles required. They will now have to determine whether it is cheapest to work in the old way, and use large quantities of cannel coal—much of it at a high price—or adopt the new process, and use cheap parrots, shales, and common coals. Some of the gentlemen who took part in the discussion at our last meeting seemed to think it was a great advantage to have tars rich in light hydrocarbons; but if you consider for a moment what these rich tars cost you, I do not think you will be of the same opinion. If their view of the question is correct, why not condense the gases so as to take a larger portion of the light hydrocarbons out of the gas? This could be accomplished at almost no expense whatever, and they might be able to double the amount of naphthas in their tars, and reduce their gas from 27 to something like 20 candles. The price of 100 lbs. sperm value of some of the coals and shales principally in use is as follows:—

Boghead coal at 85s.	. . . . .	4s. 2d.
Lesmahagow „ 35s.	. . . . .	2s. 6d.
Wemyss „ 30s.	. . . . .	2s. 2d.

Third-class parrot coals, containing from 700 lbs. to 900 lbs. sperm value, can be bought at from 7s. to 9s. per ton, which price gives 100 lbs. sperm value for 1s.

Shales, containing from 800 lbs. to 1200 lbs. sperm value, can be bought at from 5s. 6d. to 9s. 6d. per ton, which gives 100 lbs. sperm value for from 8¼d. to 9½d.

Splint coals, containing from 600 lbs. to 700 lbs. sperm value, can be bought at from 5s. to 6s. 6d. per ton, which gives 100 lbs. sperm value for from 9d. to 11d.

These sperm values are arrived at by the old methods of condensation, and the prices are at the pits.

I think it may be assumed that the average price of all the gas-making materials used in Scotland will be about 17s. to 18s. per ton at the gas-works, and the quantity of gas produced per ton will average about 10,000 feet, or from 1s. 8d. to 1s. 9d. per 1000 feet. If the new method of condensation were adopted, gas of equal illuminating power could be made from the cheap materials before referred to, which could be bought at 11s. per ton at the gas-works, and would produce about 8700 feet, and so cost 1s. 3d. per 1000 feet of gas.

The difference in the relative values of the tars and water has now to be considered, and it is necessary here to draw a distinction between those who distil their own tars out and those who sell them as they are made. As the latter is the more general way of working, we will consider it in this relation. I think it may be assumed that the average price got for these all over Scotland will not exceed 2s. 6d. per ton of coal distilled. No doubt the tars got by the new way of working do not contain the naphthas, but, on the other hand, they can be sold as once-run coal tar, and the market price of this article is, I believe, higher at present than for crude tars, and there is a large market for them. How this market would be affected by a greatly increased supply I do not know, so that I cannot follow out this part of the question further. But it has to be borne in mind, under this head, that you have, besides the decrease in the cost of the gas-producing materials, the following points in favour of the new process:—

1. Gas more easily purified, and a saving of about 12 per cent. of lime.
2. Thirty per cent. more ammoniacal water, which at the present market price is worth about 6d. per ton of coal carbonized.

There are many other points in connection with the process, and as to the proper materials to be used, that it would be well to discuss, but I leave the further discussion to you, gentlemen, who have more practical knowledge than I have.

Mr. STEWART: As one of those engaged in testing this process, I would like to say a word or two about it. I agree with Mr. Aitken that there is not the least doubt of a considerable saving of first-class coal by this process, and a considerable improvement in quality of the gas at the same time. In the ordinary process of manufacture we take second-class coal, which we can purchase at from 11s. to 12s. per ton. You get from these 9000 feet of gas per ton, and that is about 1s. 4d., on the average, for 27-candle gas. If you want from 28 to 30-candle gas, you must use first-class coal, for which you will pay at least 22s. per ton. This coal contains a large quantity of gas, and it is easily distilled, and for that reason the price is higher than the mere proportionate value of the gas it contains would warrant. I have taken a great deal of interest in this scheme, because I see that first-class coals are becoming scarcer and dearer, and, in the course of a few years, we will be driven to use second-class coals only. If you have a rich coal, you can easily increase the quality of the gas, but we want to increase the quality from the coals we have, and in this direction I think the Aitken and Young process is the best invention which we have had brought before us for a long time. It certainly will, I think, stand further investigation. What the result may be in Glasgow I do not know, but so far as my own testing goes, I am perfectly satisfied that it is a very good thing, and one that should receive consideration and attention from managers of gas-works.

Mr. MITCHELL: I have listened with pleasure to Mr. Aitken's remarks upon this process. I spent a considerable time in assisting in the process, and from the beginning I looked upon it as a success. One thing that struck me very much at the last meeting of the North British Association was the great stress that a number of managers put upon having rich coal tar. They appeared to think that if coal tar was denuded of all its naphthas before it left the gas-works it was a great disadvantage. That is not the opinion of managers in general. Their interest is to produce as good a gas as possible at a reasonable rate. Now, it is an undisputed fact that the sperm value is much easier acquired by using second-class coals with this process than by using richer coals. I have no doubt of the ultimate success of the process.

Mr. SUGG: I would like to make a remark, not so much on the process, which I do not understand at present, as about M. Brémond, of Versailles, who was referred to by Mr. Aitken as using the water-vapour process. You have to consider that there is a difference between the gas made by him in Versailles and the gas you make here. M. Brémond was first led to the adoption of his principle of passing gas over caustic lime, and finally over quicklime, in order to get rid of naphthaline, and according to his own showing he does get rid of it. I myself saw at his works two pipes, the one filled with naphthaline and the other not. The same gas passed through both, the only difference being that the gas to the one passed over quicklime and the other did not. That was his object in taking away the watery vapours. Then, in regard to carrying the gas along with the tar, that has been used in London and many parts of England, in order to get rid of the naphthaline. This, no doubt, increases the hydrocarbons in the tar. Some time ago, Mr. Harcourt, in a lecture, showed how the hydrocarbons, produced at a higher temperature, absorbed those produced at a lower temperature. Some years ago Mr. Evans pointed out that hydrocarbon vapours could be as well absorbed by tars or by oils as by bromine, and that if you passed gas over the oils or tars of any hydrocarbons produced at a high temperature, you would absorb these hydrocarbons. As you are never troubled with naphthaline, however, you never carry your gas along with the tar, in order to get rid of the naphthaline. What Mr. Aitken says is perfectly correct. If you take tar and distil it, and take out the lighter hydrocarbons, it will take out the hydrocarbons of the gas, and, where the gas passes in contact with the tar, although it may get rid of the naphthaline, or prevent a deposition of naphthaline, there is no doubt, although it is disputed, that it reduces the illuminating power. In London, it is beginning to be noticed that it is better to get rid of the tar as quickly as possible from the hydraulic main, and there are several large works where I know they do this. I do not think this will have the effect of removing the naphthaline at all, but will rather have an opposite effect.

Dr. WALLACE: The report which I gave upon the experiments I made at Hamilton has no doubt been placed in the hands of most gas managers in Scotland. I have little to add, for I have not made any further experiments, though I expect to do so when the apparatus in Glasgow is completed. In regard to this process, if the object of the gas manager was to make tar rich in naphtha, this process would be the worst, but if he wants to make gas, and considers tar a secondary product, as it has always been considered, then I think this process is an immense step in advance of anything we have had before. The experiments made at Hamilton were, I think, tolerably complete. Perhaps the testing arrangements of the gas were not so perfect as they will be in Glasgow; but so far as I have been able to see, there is an improvement in the gas, and, strange to say, the difference in the quality of the tar has not been so much as I expected—that is to say, the whole naphtha has not been taken out of the tar. In the tar made at Hamilton, though the proportion of naphtha is less than in tar made in ordinary circumstances, yet there is something like half of the quantity left. I shall not be content until I see a larger proportion of the naphtha taken out than has been the case hitherto.

Mr. YOUNG: I would like to say a few words before this discussion closes. We are indebted to Mr. Sugg for coming here. His presence and remarks show the advantage of intercommunication by people working out different ideas. He has made reference to the trouble experienced by naphthaline where poor coals are used, and he pointed out that the passing of gas over quicklime prevents the deposit of naphthaline. There are two ways of preventing the deposit of naphthaline from coal gas. The first is to remove it from the gas altogether by exposing it to something that will absorb it—such as the method adopted when the tars and gases are allowed to travel some time together until they become perfectly cooled; and the second is to diffuse through the gases the vapours of some hydrocarbons which have an affinity for the vapours of naphthaline, and hold them in suspension. The former of these processes has been extensively adopted in England. However, we hear from our friend, Mr. Sugg, to-day that a number of managers are no longer believing in the efficiency of this process, as they are now taking off the tars at the hydraulic, and removing them from further contact with the gases. I think what has been brought before the meetings of this Association, in connection with the Aitken and Young process, has pretty clearly shown that this process of keeping the tars and gases in contact would be a losing one, because the very conditions which would enable the tars to absorb naphthaline from the gases would also enable them to absorb the naphtha vapours from the gases, which are valuable as illuminants. The second process has been pretty extensively employed in America, where volatile hydrocarbons resulting from the first of the distillate of petroleum have been employed to diffuse through gases containing naphthaline, and hold them in diffusion, and I have great hopes that this new analyzing process will have a like effect in preventing the deposit of naphthaline, as it diffuses through the gases a much larger quantity of naphtha vapours than is ordinarily done. Indeed, in England, when pipes have got choked up with naphthaline, it is a common practice to pour into these pipes naphthas, so that the vapours may dissolve the naphthaline and carry it forward in diffusion. With reference to the influence of watery vapours, it has been found that dry gases, when perfectly saturated with the vapours of hydrocarbon, such as benzole, can no longer hold them in suspension when brought in contact with watery vapours, their having the effect of inducing a precipitation of the denser vapours. Now, may not this drying of the gas have the effect of preventing the precipitation of some of the naphtha vapours, and thereby enable the gases to retain in diffusion the naphthaline which they may contain? I am strongly of opinion that this is the case. Then, in regard to the naphthas left in the tars, Dr. Wallace says that although this invention has been able to remove a certain quantity from the tars, and diffuse it through the gases, yet there is a certain quantity allowed to remain. I

believe that, with the most perfect instrument, so long as we use rich coals there will be left a surplus of the denser naphthas, because the rich gases are not able to take up those naphthas and hold them in suspension. To utilize those denser naphthas it would be necessary to employ some poor gas-producing material. There is no doubt that this process effects a considerable saving, and that the principles on which it is based are sound, and gradually, as they are better understood, they will be more extensively adopted. It only requires a little time, perhaps, to develop the mechanical arrangements by which the most perfect results may be obtained.

Mr. AITKEN: In regard to what Mr. Sugg said about naphthaline, I may state that I met a gentleman who had put up works at Woolwich, and he had to employ three or four men to free the pipes and burners from naphthaline. He said that he immediately cured it by taking the gas and putting it into a large vessel, 30 feet high and 5 feet in diameter, full of coke, and pumping the tar through it. I asked him if he had tested the illuminating power, and he said he had not, but he was glad to get rid of the naphthaline and the men who were employed to prick the burners. The object of M. Brémond is to get rid of the naphthaline, and I must say I do not understand how naphthaline is formed—whether it is in the gas as it travels along in combination with other hydrocarbons, and is, so to speak, not a separate body in the gas, but simply a portion of that complex substance known as coal gas; or whether it is a separate body held in the gas under certain circumstances, and dropped under others. As I understand M. Brémond, he favours the first idea; I incline, with Mr. Young, to the latter, and think further that it drops down from the gas with the aqueous vapours in the same way as the naphthas do when the gas is suddenly lowered in temperature. We know that dried gas will deposit only a very small amount of its naphthas on a sudden change of temperature, whereas undried gas deposits a very great amount, and the same law seems to apply to naphthaline. We also know that dried gas will take up the same amount of water as it contained before being dried, if water is presented to it, temperatures being equal. I cannot see my way through M. Brémond's article, but perhaps more study may convince me that what he says is correct. I think we shall accomplish what Dr. Wallace points at, and take all the light naphthas out of the tars, or prevent them from getting in to them.

A vote of thanks was accorded to Mr. Aitken, on the motion of the PRESIDENT, and the discussion closed.

The next meeting of the Association was fixed to take place in Paisley in April, 1878.

Votes of thanks to the president and to Mr. Carlow, the secretary, brought the business meeting to a close.

In the afternoon the members of the Association, along with a number of the directors of the Helensburgh Gas Company, dined at the Imperial Hotel—Mr. M'Gilchrist in the chair, and Mr. Stewart, of Greenock, discharging the duties of croupier.

On the following day (Friday) a number of the members, with their friends, drove in waggonettes from Helensburgh up the Gareloch, thence along Loch Long to Arrochar, and from there to Tarbet, on Loch Lomond, where a picnic was held. Afterwards the company drove down Loch Lomond, *viâ* Luss, back to Helensburgh, were all arrived safe, and well pleased with their day's enjoyment.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There has been very little alteration during the week in the general state of any of the branches of the local and district iron trade, and there are such heavy stocks of pig iron in all directions that it seems entirely futile to suppose that any change for the better can possibly take place this year. At the beginning of the present quarter there seemed some chance of this improvement becoming general, but the partial alteration which then took place has not been maintained, so that in not a few quarters matters are now at a lower ebb than for many months past. This is especially noticeable in the forges and mills throughout this district, and has, in one instance, brought about the suspension of payment by, and the winding-up of, an iron concern—the Northfield Iron Company, Limited, near Rotherham. Even the largest iron-making concerns of the neighbourhood are exceedingly stagnant, and at more than one of them further measures of retrenchment are being put in force, by discharging workmen and generally by lessening the staff. The smaller foundries, too, are feeling the pressure of the times rather severely and are now doing very little work. At such concerns, however, as have every requisite for smelting and manufacturing cheaply, there is a fair amount of work in hand on gas and water mains, gas-works requisites, and general machine castings for various large towns in this country, and also on account of foreign orders.

The coal trade is rather quieter, owing to the termination of the Baltic shipping season, and the continuance of open, mild weather. The partial advance of prices inaugurated at the beginning of the month is but irregularly upheld, and any further rise would appear to be at present almost entirely out of the question.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Business generally is anything but good in the coal trade of this district, and although the colliery firms who raised their rates at the commencement of the present month maintain the advance, it has not been followed in other districts, and there are still plenty of sellers in the market at as low prices as ever. For the better classes of round coal there is a moderate demand, but very little of the push of orders which is usual at this time of the year, whilst the common sorts used for forge and general manufacturing purposes are extremely difficult to sell, owing to the general depression in trade. Engine classes of fuel continue a complete drug, slack being more plentiful in the market, and, if anything, lower in price. The average quoted prices at the pit mouth are about as under:—Good Arley, 10s. to 11s. per ton; Pemberton four-feet, 8s. to 8s. 6d.; common coal 5s. 9d. to 6s. 6d.; burgy, 5s.; good ordinary slack, 3s. 6s. to 4s.; common ditto, 2s. 9d. to 3s. 3d. per ton; but even lower prices than the above are in some cases accepted for good orders.

The annual meeting of the South Lancashire and Cheshire Coal Owners Association was held at Manchester on Tuesday. Mr. Clifford Smith, of the Bridgwater Collieries, the retiring president, delivered an address, reviewing the various subjects which had occupied the attention of the association during the past year, and a vote of thanks having been passed to him for his services, Mr. R. Fletcher, jun., was elected president for the ensuing twelve months.

The iron trade of this district still shows no signs of improvement, and although local makers of pig iron are firm in maintaining late rates, north country brands of iron are being pushed in this district at extremely low figures, which in some cases must be considerably less than the actual cost of production. Finished iron also continues in a very depressed condition, and although Lancashire bars delivered into the Manchester district are still quoted at from £6 10s. to £6 12s. 6d. per ton. There is so much keen competition for every small order placed in the market, that to do business some slight concessions have generally to be made, and for good specifications very low prices are quoted.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The gas trade of the Tyne is active. All the best collieries are very fully employed. The shipments by sea are a November average. The price of best gas is steady at 8s. per ton f.o.b.; mediums, 7s.; inferior sorts, 6s. per ton, less 2½. These are likely to be the winter prices. Since the last report, a few more orders have come from the United States, mostly from Boston and the State of Maine. Clear of the ordinary port charges, the price of best gas coals delivered at Boston, U.S., is 16s. 6d. per ton. It is made up thus:—Price of coals delivered on board at Tyne Dock, 8s.; freight, 5s.; American protective duty, 3s. 6d. Remarkable as it may appear, the freight on a ton of coals delivered at Boston by steamer is exactly the rate paid a steamer for delivering a ton of coals in London river, and 1s. 6d. per ton less than the freight paid to a sailing ship to discharge a cargo of coals at a wharf in the Thames. It is 1s. per ton less than the rate charged upon coals sent to Boston from British America, and British coals have cut them out for the time. Of course, whatever coals a steamer takes out, it is so much gain to the owners, as the substantial profit is upon the cargo of wheat brought home by her. House coals are very firm in the market. The rates are 12s. to 13s. 6d. per ton best, 11s. medium, and 10s. to 10s. 6d. inferior. Steam coals are lower in price. Medium qualities are quoted at from 9s. 6d. to 10s. per ton; best is 11s. per ton.

The market has been very well supplied with sailing tonnage for the coast. A good few small orders have been astir for the east coast and British Channel. Handy vessels have been chartered pretty briskly for the bye-ports at an advance of 3d. per ton. There has been a rise in French business of from 2s. 6d. to 5s. per keel. There is very little astir for the Baltic or Mediterranean trades. Coasting steamers are engaged at from 4s. 9d. to 5s. per ton for London. This is a corresponding improvement with the slight advance paid to sailing ships. It may be taken as the maximum rate likely to be current for steamers to load for London during the winter. For in a very short time there will be an abundant supply of steamers seeking employment in coasting.

It has been an observation that when things are at their worst they mend. This should apply to the iron trade of the North of England. There is absolutely nothing to report in connection with this trade. Manufacturers get along from week to week as best they can. The most satisfactory feature of business seems to be that rotten firms and companies have been weeded out, and that the trade is now established upon a good substantial basis. There are the usual exports of pig iron, mostly to the Continent. Gas and water pipes have likewise been shipped lately in larger quantities. The iron shipbuilding and engine-building trades of the Tyne and Wear are doing tolerably well. The chemical market is extremely slack. There is not much astir in the fire-clay goods and cement trades.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At a meeting of the Peterhead Town Council, held last Thursday, some remarks were made by Bailie Will which seemed to indicate that the adoption of the Burghs Gas Supply Act is likely to be one of the events of the immediate future in that town. There is a desire to have a district called the Roanheads brought within the area of supply, but hitherto the gas company have declined to put down pipes in that locality, in the belief that it would not be remunerative to do so. It is considered very probable that the district in question would be lighted by the Police Commissioners if they had the Act adopted.

Mr. Hall, of St. Andrew's, the new President of the North British Association of Gas Managers, has been elected a member of the town council and also Dean of Guild in the ancient university city of St. Andrew's.

The Kilbarchan Gas Company have agreed to reduce the price of gas from 6s. 8d. to 6s. 3d. per 1000 cubic feet, and the directors have remitted to the Works Committee to make arrangements for a systematic testing of meters, as also to renew a portion of the main-pipes if found necessary.

The directors of the Lochmaben Gas Company have reduced the price of gas from 8s. 4d. to 7s. 5d. per 1000 cubic feet, the reduction to take effect from the 1st of November.

For the week ending Nov. 3, the official report on the illuminating power of the Inverness gas showed a maximum of 27·72 candles, and a minimum of 27·18 candles, the average being 27·45 candles. For the same week in Glasgow the minimum was, in one instance, at 25·74 candles, and the highest minimum was 27·89 candles. The maximum ranged, over three testing-stations, from 26·94 candles to 28·15 candles, and the average at West Street station was 27·98 candles. These figures show a good deal better than those given for the Perth gas during the week ending Nov. 8—maximum, 24·82 candles; minimum, 24·56 candles; average, 24·68 candles.

The usual monthly meeting of the Dundee Gas Commissioners was held last Thursday, when there were brought under consideration the question of accepting loans of small sums of money, under the new local gas Act, and the question of deposits in security of payment for gas-rentals. After some discussion, the treasurer was empowered to accept loans of even the smallest amounts at 4 per cent. interest. It was stated that the Police and Water Commissions had the names of over 1500 small lenders in their books, and that the deposits amounted to £165,000. It was resolved to allow 5 per cent. interest upon deposits taken as security for the payment of gas accounts. Already there are 3300 deposits in the hands of the treasurer, representing about £1200. On Friday the Chamber of Commerce elected five members to sit on the Gas Commission—Messrs. George Carmichael, Alexander Maxwell, George Halley, David Cargill, and W. Y. Martin. An interesting speech on gas affairs in Dundee was made during the proceedings by Mr. Maxwell. Amongst other things, he said that the consumption of gas in Dundee had now risen to 300 million cubic feet per annum, and that it was probable that the increase during this year would be equal to that of any former years.

The Dunfermline Town Council have resolved to apply to the Public Works Loan Commissioners for a loan not exceeding £70,000—the full borrowing powers of the Water Act—at 4 per cent. interest, extending over a period of 50 years, the principal and interest being repayable by way of annuity at the rate of £4 13s. 2d. per cent.

New water-works for Kirriemuir were formally opened on Thursday last by Mrs. Maclaggan Wedderburn, of Pearsie, upon whose estate the reservoir is situated. The total cost of the scheme is £4500, and the reservoir is capable of containing fully a week's supply, at the rate of 270,000 gallons per day, being about 30 gallons per head of the population. On the preceding day the Police Commissioners of Alloa inaugurated an important addition to their water supply powers. Strenuous efforts are now being made for the purpose of improving the water supply of New Elgin.

The quantity of water sent into Edinburgh and district during the month of October was 8,893,635 gallons, or 31·35 gallons per head per day to the estimated population of 286,800.

There has been some improvement in the demand for, and an advance in the price of pig iron during the past week, but no improvement can be reported in the coal trade.

Salford Corporation Gas-Works.—We understand that, in response to advertisements in this Journal during the past month, the Gas Committee of the Salford Corporation received from various makers designs and prices for the supply and erection of four gas exhausters, capable of passing 60,000 cubic feet per hour, with engines and all fittings, and that the design and tender of Messrs. Robert Dempster and Sons, engineers, of Elland, have been accepted.

Alfreton Water Supply.—The Local Government Board have sanctioned the loan by the Public Works Loan Commissioners to the Rural Sanitary Authority of Alfreton of a sum of £17,000, for works of water supply for so much of the parish as is not included in any urban district, such sum to bear interest at the rate of £4 per cent. per annum, and to be repaid within a period of 50 years. They have also forwarded to the Alfreton Local Board sanction to borrow £10,500 in respect of their contribution towards the proposed water-works.

Personal Honours.—Colonel Makins, M.P., a director, and Mr. John Orwell Phillips, the secretary of The Gaslight and Coke Company, have been nominated by the late Lord Mayor, under permission of Her Majesty, to be Deputy-Lieutenants for the City of London.—At the annual meeting of the Ipswich Town Council, on the 9th inst., Mr. Ebenezer Goddard, manager of the Ipswich Gas-Works, past-president and one of the trustees of the British Association of Gas Managers, was elected an Alderman of the Borough. Mr. Goddard has been an active member of the town council for about a quarter of a century, and has thrice held the office of mayor.

Cooking by Gas.—The *Freeman's Journal* says that Mr. Gladstone, on his visit to Maynooth College, went to the kitchen, in which the dinner was being cooked. The stoves were all lighted with gas, and the food was inside. He asked how many were fed, and learned that, with servants and others, 500 a day had to be provided for. He questioned the cook with anxious and indeed amusing severity, his manner showing that even in this immaterial matter he was "doing his best" to know all about it. He seemed to regard the system with approval, and observed that it was clean, economical, and not unsavoury; adding, "There is little or no smell, and all smell is waste."

Heanor Gas Supply.—At the meeting of the Heanor Local Board, last week, the clerk read a letter from the Local Government Board, in reply to an inquiry as to the purchase of the Ilkeston Gas-Works by the board. The Local Government Board, it appeared, were of opinion that the Ilkeston Board would require additional powers for the purpose of supplying the town with gas by means of the present works, which they had agreed to purchase, or any additional works which might be required. They were also of opinion that the best method of obtaining such powers would be by means of a Provisional Order. The clerk stated that the letter had been considered by the Gas and Watch Committee, and they decided that the requisite power should be sought by Provisional Order.

Birkenhead Gas and Water Supply.—At the monthly meeting of the Birkenhead Improvement Commissioners on the 5th inst., Mr. Henderson, quoting from the accounts for 1877, said that, since their acquirement by the commissioners, the gas and water undertakings had made a profit of £28,487, in addition to the setting aside of a contingent-fund of £2998, and a sinking-fund of £19,367; and notwithstanding all the heavy charges consequent on the extension of the gas-works, the commissioners were now selling gas at 3s. 9d., and water at a corresponding reduction from the maximum rate. The price now charged for gas and water was 25 per cent. under the maximum, and was the lowest rate that had been charged in the town.

Glasgow Water Supply.—The quarterly report by Mr. J. M. Gale, C.E., the corporation engineer, shows that the quantity of water sent into the city and district from the Loch Katrine and Gorbals works during July, August, and September, averaged 34,300,000 gallons daily, being an increase of 400,000 gallons over the average for the corresponding three months of last year. All the works, it was stated, are in good repair. The laying of the pipes in the water supply districts of Hogganfield and Springburn is completed, and these districts are now supplied by the pumping-engines and high-level reservoirs constructed by the local authority. The river supply works have been completed, with the exception of the laying of the wrought-iron pipe across the Clyde, and the fixing of the meters in the works of the manufacturers who are prepared to take the water. About 39,000 people have now been placed under district meters, and two other districts, being Nos. 5 and 6, have been authorized to be brought under the same system during the last three months, at an estimated cost of £1019. The completing of this work has been delayed by the meters not coming forward from Liverpool. When the whole is completed there will be 39 meters, covering a population of about 65,000.

Gas Tar as a Seed-Wheat Dressing.—A correspondent of the *Western Morning News* says: "So many people ask or write to me about my plan of dressing seed corn, that you will oblige by giving insertion to the following particulars:—I am now drilling wheat for the sixth year, dressed with gas tar, and have never known it fail with wheat, oats, or barley. Two years ago a new foreman I had persuaded me that rooks would not touch winter oats if not dressed. I foolishly listened to him, and the consequence was it cost me some pounds to keep the rooks from them, whilst they never attempted to touch six acres of winter barley, which was dressed with the tar, in the same field. Besides being so sure in its effects, it has the advantage of cheapness, as the cost is little, if anything, over 1d. per acre. Gas tar can be had at any gas-works at from 3d. to 6d. per gallon, and I have bought it at 10s. per ton for other purposes. My plan is as follows:—Dress the corn with blue stone as usual, making it thoroughly wet, then mix nearly a pint and a half of tar with some hot water till it is thin enough to run freely, and pour over a sack of corn, stirring it till every kernel is dark with tar. Let it remain a few hours, or all night, and then sift and mix with it sufficient slaked lime to prevent any stickiness, and it will be fit to drill. Now that boys cannot be had at any price, and men are too expensive, it is our own fault is we suffer from the ravages of the rooks, unless it be in the case of peas or beans, for which it cannot be so thoroughly depended on."

Influence of Gaslight upon the Eyes.—The verdict of a scientific deputation for medical purposes has been presented to the Prussian Minister of Education. *Lithographia* extracts the following, which refers to living and study rooms, but is equally applicable to printing offices, factories, &c.:—"According to the previous experiences of oculists, no injurious effect of gaslight upon the pupils of eyes has been observed, when it has been used properly, and especially where arrangements are present to protect the eyes from the direct influence of the bright flame. In general, shades and globes serve for this purpose. The dark, totally opaque tin shades are, however, very injurious, and all complaints against the use of gaslight are referable almost universally to these improper contrivances. With these, the eye stays in total darkness, but looks upon a brightly illuminated surface, so that a dazzling and over-irritation or super-excitement of the eye result, with all the attendent injurious effects. Very suitable are the globes of milk glass, which diffuse the light more, and the eye is not injuriously affected. Experience shows that more heat is generated by gaslight, hence the gas-flame must not be brought too near the head, because the radiant heat which it sends out might cause headache and congestion of the brain. Where several persons are using the same flame, the source of light has to be higher up, so that the unpleasant effect of the radiant heat disappears, especially if the so-called 'plate' illumination is used, which consists of a large funnel-shaped globe of milk glass, closed beneath by a plate, whereby the descending rays suffer a proper diffusion and loss of intensity, and at the same time the flickering of the flame by breaths of air is avoided, and a more steady and quiet source of light is secured. Under special circumstances, where the eyes are particularly sensitive, chimneys of a blackish blue colour may be employed. Under such precautions an injurious effect of gaslight upon the eyes is not to be feared in the least."—*Scientific American.*

Gas Explosions in Scotland.—Of late gas explosions have been unusually frequent in Scotland. The latest is one which occurred in Glasgow on Thursday night. A man named Hugh Dunlop, Adelphi Street, Bridgeton, entered a closet with a light in his hand, and as the gas had been escaping from an open pipe in the confined space, an explosion took place, and he got burned about the head, neck, and face, but not dangerously. Other damage was done. Late at night, on Saturday week, the inhabitants of Kirkwall were alarmed by the gas suddenly going out throughout the town. It appears that the pipes in Harbour Street had been leaking for some days, at a place where drainage and water supply works were being excavated, and some person had applied a lighted match, which instantly caused an explosion. The houses in the locality were shaken, and the escaping gas burned through cracks in the street for some yards, as if the street were on fire, and the gas was ordered to be turned off at the works. In about twenty minutes, however, the gas was again turned on. During last month there were three explosions in succession, on consecutive days—one at Dysart, on the 16th; one at Edinburgh, on the 17th; and one at Brechin, on the 18th. In the first case, the explosion occurred in a house that had been undergoing repairs, the laths and plaster being stripped from ceiling to floor in the room where it took place, and a door being torn off its hinges. Fortunately no person was hurt. The explosion which happened in Edinburgh was due to an escape of gas from a street-main in the Causewayside district, where a large water-main was being laid. A great destruction of property was the result, but no personal injury occurred. The Brechin explosion originated in an escape of gas into a street-drain, and when a light was applied in order to learn where the leak existed a violent explosion occurred, which even extended into a house in the vicinity, overturning the hearthstone, and doing a great amount of damage to the house furniture, crockery, &c. A woman who was in the house at the time had a narrow escape.

Abyssinian Tube Wells.—At a meeting of the Society of Engineers, on the 5th inst.—Mr. Thomas Cargill, C.E., President, in the chair—a paper was read by Mr. Alfred Le Grand, on "Tube Wells." The paper dealt with the subject of tube wells, commonly known as "Abyssinian," which were introduced about 10 years ago by Mr. J. L. Norton. The author described the system as a modified form of pile-driving, employed to drive tubes into the earth principally in search of water-bearing strata, thus obviating the necessity of well-digging. A tube furnished with a steel point, and perforated near the end, is driven by a hollow weight, which is guided by the tube, and which falls upon a clamp bolted to the tube. Tubes are added by screwing them on like gas-pipes. When water is reached, the fine particles of the soil are pumped out, until a clear natural filter remains around the perforations. In favourable soils the tubes can be driven to considerable depths; and if the water, when tapped, does not rise within lifting reach of a suction-pump, a long-barrelled pump, formed of the tube, can be driven, and the rod carrying the pump-bucket works inside the tube, by means of a lever fixed above the surface. These wells can be withdrawn when required, and re-driven in a fresh spot. The author described a new method of driving tubes, which has recently been introduced by Messrs. Le Grand and Sutcliff, and which consists in driving them by means of an elongated weight, which passes down the inside of the tube, striking its blow immediately above the point. This method of driving is particularly suitable for operations carried on under water, and is thus applicable to driving piles, telegraph and other posts. The smaller wells and apparatus are principally adapted for small supplies of pure water, from 300 to 500 gallons per hour, and are applicable for household purposes; for the supply of moderate-sized boilers, and for campaigning and exploring expeditions. The author reserved the description of tube wells of increased size for large supplies of water for another paper, which is to be read before the society at the next meeting.

Register of New Patents.

2387.—Lovell, T., Attleborough, near Nuneaton, "*Improvements in purifying sewage, and in the means and apparatus for effecting the same.*" Patent dated June 7, 1876.

This invention consists of a method of purifying sewage by means of tanks and runlets, the raw sewage being carried for long distances over small portions of land. By these means, and with the addition of settling-tanks in duplicate, the mud is collected in its passage down, and the liquid sewage is further purified, by means of the runlets in the latter end being planted with succulent herbage or aquatic plants.

The sewage on leaving the outfall sewer is let into one of a pair of settling-tanks about three or four yards wide, and of any suitable length, from which it is conveyed by overflowing into a similar but smaller tank. From this it overflows into a series of shallow parallel trenches, made by digging out the soil to the required depth, having a fall in them according to the inclination of the ground for the distance of some quarter of a mile or more, when it flows into another tank, and then into another series of runlets for another quarter of a mile more, and so on for a distance of not less than two miles.

2409.—Fison, F. W., Eastmoor, Ilkley, Yorks, "*Improved means or apparatus for exhausting gas-retorts.*" Patent dated June 10, 1876.

This invention relates to the means of drawing away from gas-retorts the gas as it is generated, and in a regular manner or at an uniform pressure, whatever be the speed of generation.

The improvements consist in combining an ordinary exhauster with any kind of motive power (but by preference a gas-engine) and certain other appliances, in such manner that the uniform speed of the motive power is converted into the varying speed of the exhauster consequent upon the varying quantity of gas made or generated; the rate of speed of the exhauster being indirectly regulated by the appliances referred to. These consist of a pair of ordinary conical driving rollers placed between the motive power and the exhauster, with a screw shaft for traversing the driving belt as usual, and of an improved regulator. A rod in connection with the bell or float of the regulator is connected to a lever carrying two friction pulleys driven in opposite directions to each other in such manner that either one or the other of them, or neither of them, can bear in or upon another friction pulley fixed on the screw-shaft. Thus the shaft is turned in either direction, or remains at rest, according as to which pulley is in contact with the pulley on the screw-shaft; or neither of them

may be in contact with the shaft, so that the belt or strap will be traversed to vary the speed of the exhauster, which can thus be increased or diminished according to the increase or decrease of pressure of gas in the interior of the bell of the regulator. There is also a moveable weight so applied to the spindle of the bell as to prevent any undue oscillation in the rate of speed of the exhauster.

[This invention was the subject of a paper read by the inventor at the 1876 meeting of the British Association of Gas Managers. See JOURNAL, vol. xxviii., p. 169.]

2430.—NORTH, J., Southington, Conn., U.S.A., "*Improvements in steam-pumps.*" Patent dated June 12, 1876.

This invention consists in the combination of an oscillating steam-valve with a steam-moved piston-valve extending transversely to the steam-valve, and fitted into an auxiliary cylinder, the ends of which communicate with the main cylinder. The oscillating steam-valve works in glands fitted into the steam-chest, and is provided with a stem which extends though one end of the steam-chest, so that by applying a suitable lever or starting bar the steam-valve can be moved by hand for the purpose of starting. The steam cylinder and the pump cylinder are secured together by a tubular connection made in sections, each section containing a gland and stuffing-box, so that when the sections are drawn together, either by a nut or by flanges and bolts, a steam-tight joint is formed on the piston-rod, which extends through the tubular connection. The double-acting pump cylinder has two induction and two eduction ports located on each side, or nearly on a line with the centre of the pump cylinder, and all the ports have separate passages one from the other, and the valve from each pump and its seat are likewise independent of each other, so that the pump can be worked single or double acting.

2455.—BRADDOCK, J., sen., Greenfield, Yorks, and BRADDOCK, J., jun., Oldham, "*Improvements in the construction of governors for regulating the flow of gas or air.*" Patent dated June 14, 1876.

This invention relates to means for regulating and governing the flow of gas and air in pipes and mains for the purpose of maintaining an uniform pressure at the outlet of the governor under all the various changes of the flow of gas or air, when such flow is not in excess of the capabilities of the size of the governor and the quantity of gas or air it is made to control.

The class of governor to which this invention applies is that in which a bell floating in water is caused by the pressure of the air or gas to raise or lower a conical plug bedding against a valve seating, thus regulating the supply and keeping it at an even pressure.

The gas or air is caused to flow in such a direction that its tendency is to open or depress the conical plug-valve, and in order to counteract the effects of the varying inlet pressure on this plug, there is constructed within the bell a cylindrical compensating chamber, the diameter of which is equal to that of the conical plug, and communicating with the gas at the inlet pressure; thus the pressures tending to raise the bell and depress the valve being equal, an equilibrium is maintained.

The main part of the bell is connected, by means of a pipe, to the gas in the main or at the outlet pressure, and the bell itself being weighted or counterbalanced accordingly, this outlet pressure will be steadily maintained, however the inlet or initial pressure may vary. It will, of course, be understood that the initial pressure must in all cases be greater than the outlet pressure required.

[This invention was described and illustrated in the JOURNAL, vol. xxix., p. 19.]

APPLICATIONS FOR LETTERS PATENT.

4071.—KIRKHAM, T. N., Westminster, HULETT, D., High Holborn, and CHANDLER, S., Newington Causeway, London, "Improvements in apparatus for condensing, washing, and purifying gas and other vapours." Nov. 2, 1877.

4112.—BRAY, G., Leeds, York, "Improvements in gas-burners." Nov. 5, 1877.

4114.—BECK, G., Queen Square, and JUSTICE, P. S., Chancery Lane, London, "Improvements in nozzles for the escape of steam or gases under pressure." Nov. 5, 1877.

4118.—SPENCE, P., Manchester, "Improvements in the treatment of spent oxide of iron arising from the manufacture of gas, for the purpose of obtaining certain valuable products, and for rendering the said oxide again fit for use." Nov. 5, 1877.

4134.—MILLS, B. J. B., Southampton Buildings, London, "Improvements in the manufacture of gas for lighting and heating purposes." A communication. Nov. 6, 1877.

4139.—LEZIUS, H., and ZABEL, H., Breslau, Prussia, "Improvements in self-closing valves or waste-water preventers for general uses." Nov. 6, 1877.

4154.—HOWARD, J., Erith, Kent, WILSON, A. F., and KINGDOM, H. W. A., Southwark, London, "Improvements in automatic apparatus for regulating the flow of liquids under pressure, and prevention of waste of water." Nov. 7, 1877.

4156.—HART, A. H., and POTTER, J. J., Birmingham, "Improvements in valves for liquid, steam, and gas pipes." Nov. 7, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

1946.—BRUCE, T., Shotley Bridge, Durham, and ROBB, J., Stepney, London, "Improvements in rotary engines and pumps." May 18, 1877.

2094.—CLARK, A. M., Chancery Lane, London, "Improvements in electric light apparatus." A communication. May 29, 1877.

2417.—PAUL, E., Liverpool, Lancs, "Improvements in and connected with pumps." June 22, 1877.

3007.—SHONE, I., Wrexham, Denbigh, "Improved apparatus for raising and forcing water or other liquids." Aug. 7, 1877.

3372.—WEYHE, W., Bremen, Germany, "Improvements in pumping-engines worked by fluid pressure without valve-gear." Sept. 5, 1877.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

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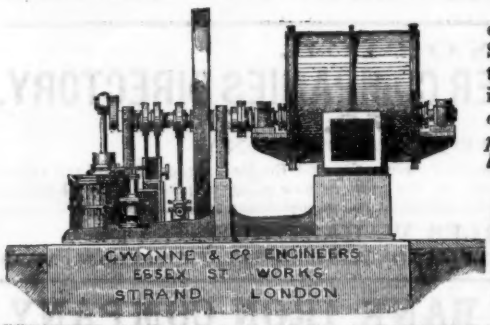
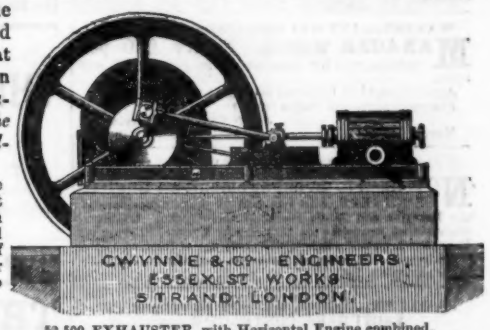


EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



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GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure. Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

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Beg to announce that they have REMOVED to their New Premises,

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Address, stating age, wages, &c., to No. 417, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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WANTED, a steady, active Man as FOREMAN of LAMPLIGHTERS; one who has filled a similar situation preferred. Wages 28s. per week.
Apply, in own handwriting, stating age and references, to CLEMENT DUNSCOMBE, Borough Engineer, DERBY.

WANTED, a steady, first-class Main and SERVICE LAYER (none other need apply) Constant employment.
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WANTED, a steady Man as Gas-Fitter. Must understand in and out door fitting, and be willing to make himself generally useful. Constant employment. A young man as improver not objected to.
Apply, with testimonials, stating wages, to E. M. JONES, Manager.

WANTED, the Address of Gas Companies who have not received a Copy of the New Edition of PAMPHLET for GAS COMPANIES to distribute to their Gas Consumers—"Cooking and Heating by Gas." Price £6 for first thousand. Copies by post Threepence—direct from the Author, MAGNUS OHREN, Gas-Works, SYDENHAM, S.E.

WANTED, by a Young Man, the son of a Gas Engineer, a situation as ASSISTANT in a large Gas-Work, or as Manager of a smaller one. Is a good draughtsman, has a knowledge of chemistry, and is quite competent to take charge of a work. Can be well recommended.
Address No. 415, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.
John Leigh, Esq., M.R.C.S., F.C.S, &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

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MANAGER wanted. Salary £60 per annum, with free residence, large garden, fuel, and light.
Application to be made not later than the 28th inst.
For particulars and duties apply to
JAMES COULSON, Secretary.
Nov. 9, 1877.

FOREIGN GAS-WORKS.

NOW open to an engagement, an English ENGINEER, who has had 20 years experience in the Erection and Management of Gas-Works. During a professional residence of 15 years in France, Spain, and Italy, has acquired a thorough knowledge of the languages.
Address R. T., care of Matheson and Grant, 32, Walbrook, LONDON, E.C.

TO GAS ENGINEERS, GAS APPARATUS MANUFACTURERS, CONTRACTORS, &c.

A Gas Engineer, aged 30, who has been engaged as Assistant Engineer in the erection of Gas-Works in five large towns during the last ten years, is open to an engagement. Is a good draughtsman, a competent analyst, and is well acquainted with the manufacture of ammoniacal salts. An engagement which might lead to a future partnership preferred.
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ON SALE—One Station-Meter, to pass 1000 cubic feet per hour. Almost new. Will be sold cheap.
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THE Newmarket Gas Company have for immediate SALE a 6-inch GOVERNOR, with four-way bye-pass valve and connections complete, in excellent condition, replaced by larger.
Price and particulars may be had on application to the undersigned,
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GAS PLANT FOR SALE, suitable for Small Works:—
Seventeen 4-inch and 3-inch H-Pipes.
Eighteen 15-inch Circular Mouthpieces.
A 6-inch Governor.
A Station-Meter, to pass 6000 cubic feet per hour.
Scrubber and Washer combined; very good.
Vertical Condenser; very good.
Seven 7-feet lengths, 12-inch D-shaped Hydraulic Main.
Two Gasholders, each capable of holding 15,000 cubic feet.
Apply to the ENGINEER, Phœnix Gas Company, GREENWICH.

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FIFTY tons Antrim Limestone for Sale (containing about 96 per cent. of carbonate of lime).
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THE Directors of the above Company are prepared to receive TENDERS for the TAR produced at their works for Twelve months, or such other term as may be agreed on, from Jan. 1, 1878.
The quantity at present made is about 35,000 gallons per annum.
Tenders, marked "Tar," to be sent to the undersigned not later than the 5th of December.
Any further information may be had on application.
By order,
M. RICHLEY, Secretary.
Nov. 8, 1877.

PARIS EXHIBITION, 1878.

MM. SERVIER, MONNIER, ROUGET, Engineers, specially in connection with the industry of Gas Lighting, will undertake to represent any Manufacturers who may be Exhibiting Goods in Classes 27 and 53.
References in France and England.
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WE beg to call attention to our ImPROVED STREET-LAMP REGULATORS with brass cones and burners. Sample, 3s.; carriage paid. Special Steatite Burners for Street-Lamps, 8s. per gross. Quotations for quantities. Street-Lamp Regulators, Wet and Dry Meters repaired.
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THE LAW RELATING TO GAS AND WATER: comprising the Rights and Duties, as well of Local Authorities as of Private Companies, in regard thereto, and including all Legislation to the close of the last Session of Parliament. Second Edition. By W. H. MICHAEL and J. SHIRESS WILL, of the Middle Temple, Esqs., Barristers-at-Law.
London: BUTTERWORTHS, 7, FLEET STREET, Her Majesty's Law Publishers.

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MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.
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NOTICE.
THE GAS & WATER COMPANIES DIRECTORY,
1878.
(WATER SECTION.)

The Editor will feel greatly obliged if Secretaries and Engineers would fill up, and return to him at once, the forms sent them, as the work is now going to press. If any have not received Forms, they will be forwarded immediately, on application to the Editor,

CHARLES W. HASTINGS,
8, BUCKINGHAM STREET, ADELPHI, LONDON, W.C.

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(Successors to LYNCH WHITE,)
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CAST-IRON RETORTS, SOCKET-PIPES for GAS or WATER PURPOSES, FLANGE-PIPES for STEAM, RAIN-WATER PIPES and GUTTERS, HOT-WATER PIPES and BOILERS, and all requisite Connexions for same; also LAMP-COLUMNS, LAMPS, WROUGHT FRAMES, WROUGHT-IRON TUBING, &c., &c.
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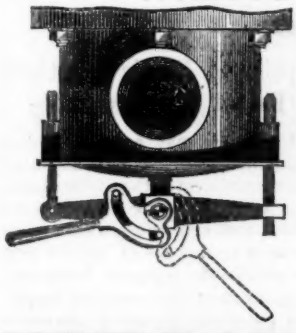

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Have now stood the test of experience, and have been found one of the greatest improvements in retort-house appliances yet invented. All who desire security and economy should give them a trial.

Prices and further particulars will be given on application to

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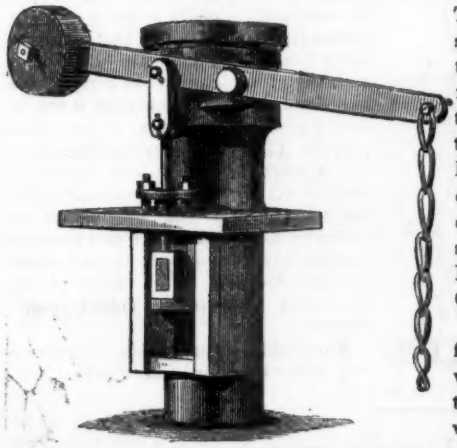

THE advantages of this Dip will be seen from the engraving. It is thoroughly effectual in its working, removing the whole of the pressure of the hydraulic main from the retort, thus causing a great saving in gas. It is very easy of manipulation, requiring little care and attention; it cannot get out of order, and, when shut, works as an ordinary Dip-Pipe. No accumulation of carbon in retort. Can be fixed to existing H-pipes.

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Application to be made to the MANUFACTURERS, the Horseley Company, Tipton, STAFFORDSHIRE.

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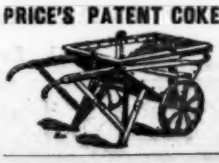

effecting a great saving of time, labour, and expense.

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Mr. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

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CONTRACTORS FOR GAS AND WATER WORKS, GENERAL ENGINEERS,

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GASHOLDERS, TANKS, PURIFIERS,

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S. C. & Sons undertake the entire Erection of New, or Remodelling of existing Gas-Works in any part of the World, including small Works for MANSIONS, FACTORIES, &c., or Works of the largest extent (are now constructing the largest Gasholder yet erected); also the Supplying and Laying of MAINS.

They make a speciality of supplying every requisite whatever for a Gas-Work, keeping in Stock what are most in request. WOOD SIEVES for Purifiers and Scrubbers, of a superior make.

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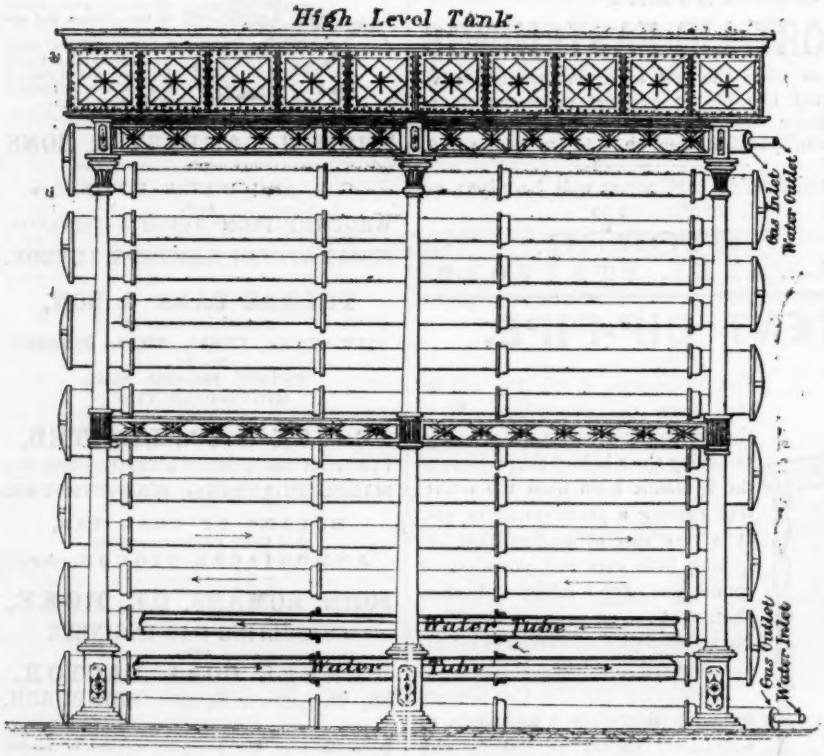
MANUFACTURERS OF

MORRIS & CUTLER'S PATENT CONDENSER

AND

CUTLER'S PATENT GAS-WASHER.

(For Illustration and Description, see "Journal" for Oct. 30, page 693.)



Description of Morris & Cutler's Patent Condenser.

The Condenser may consist of pipes arranged in tiers as shown, or in any other form most convenient to the site available, each tier being connected with special connexions, and containing within same either one or more coils of smaller pipe through which water is passed, being supplied from any convenient source of supply, the water passing in an opposite direction to the gas, so that the coldest water is at the gas outlet. The power of the Condenser can be regulated precisely in proportion to the quantity of water allowed to pass through, which is not in any way contaminated, but simply heated by the hot gas, and advantage can be taken of its being at a high level to carry it to a high-level cistern, from whence it can be used for supply to boiler or any other purpose. (The Condenser itself may form the support for a high-level cistern as illustrated.) By an arrangement of valves the water may be shut off, and an air orifice opened, when air will pass through instead of water, or both air and water can be shut off. The power of the Condenser is, therefore, entirely under control.

The Condenser may be seen in operation at the Brentford Gas-Works.

For further Particulars, apply to

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S. CUTLER & SONS,

PROVIDENCE WORKS, MILLWALL (Near the Steamboat Pier), LONDON, E.

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(KENSINGTON PATTERN.)

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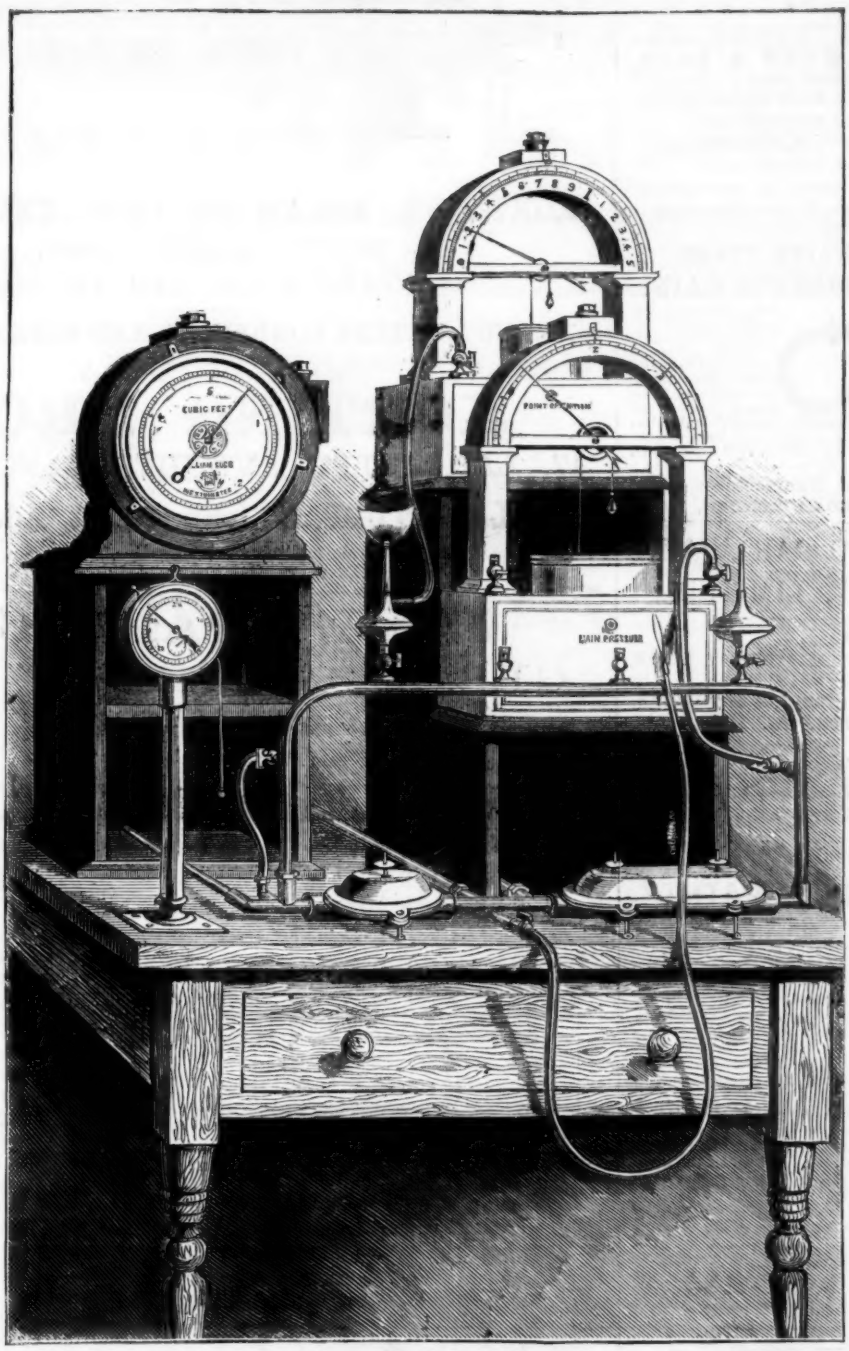
(SALFORD PATTERN.)



SUGG'S IMPROVED PATENT PUBLIC LAMP GOVERNORS.
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SUGG'S IMPROVED BRASS LIGHTING TORCHES AND COCKS.

[ENTERED AT STATIONERS' HALL.]

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IMPROVED APPARATUS FOR TESTING
STREET-LAMP GOVERNORS.

PRICES COMPLETE, AS ABOVE, ON APPLICATION.

REMOVAL.

CHARLES HEISCH, F.C.S., Analytical and Consulting Chemist, Superintending Gas Examiner to the Corporation of London, &c., &c., has REMOVED from 8, Savage Gardens, to 79, MARK LANE, where he may be consulted as usual.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

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DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for
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As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather, India-Rubber, and Gutta-Percha Machine-Bands, Sheet and Washers, and Steam Joints.

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Torbay Brown.	Torbay Red.
Dart Green.	Slate.
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Brixham Black.	Torbay Chocolate.
Light Blue.	Cream Colour.
Dart Brown.	Dart Umber.
Imperial Stone.	Light Stone.
Bronze Green.	Salmon Colour.
Navy Green.	Lead Colour.
Carriage Red.	Dark Stone.
Light Lead.	Crystal Palace Blue.
Light Green.	Iron Grey.

All other Colours made to order.

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A great variety of Colours ready mixed for the brush are also always kept in Stock, in 3 lb., 7 lb., 14 lb., and 28 lb. cans.

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PLUTONIC CEMENT,

For Jointing and Repairing Retorts and Ovens *in* action and *out* of action.

A Pamphlet on the advantages of the above, with modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,

WILLIAM RICHARDSON, GAS AND HYDRAULIC ENGINEER,
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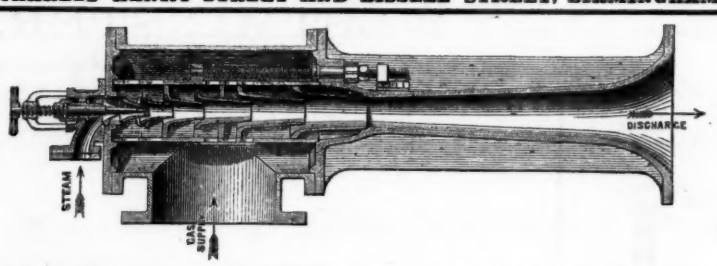

KÖRTING'S STEAM-JET GAS-EXHAUSTER.

IMPROVED CLELAND'S PATENT.

UPWARDS OF 250 IN USE.

CLELAND'S PATENT CONDENSER AND STEAM SCRUBBER.

FOR PARTICULARS, APPLY TO

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GERALD J. TUPP, 8, John Street, Adelphi, W.C., LONDON,
SOLE AGENT FOR ENGLAND AND WALES.

J. & J. BRADDOCK,
GLOBE METER-WORKS,
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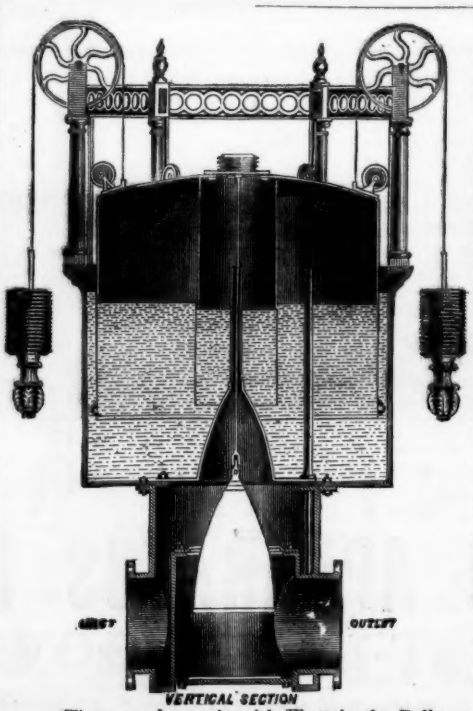
Beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

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Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

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WITH TALC REFLECTORS AND SELF-ACTING VALVES TO PREVENT DOWN-DRAUGHT;

VENTILATING GLOBE LIGHTS for DINING-ROOMS, LIBRARIES, &c.

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MEDIÆVAL CHURCH WORK AND CORONÆ

COCKS, VALVES, and FITTINGS for GAS, STEAM, and WATER;

COLUMNS, BRACKETS, & STREET LANTERNS;

BLACK AND GALVANIZED BARREL COMPO AND TIN PIPE.

GAS ENGINEERS,

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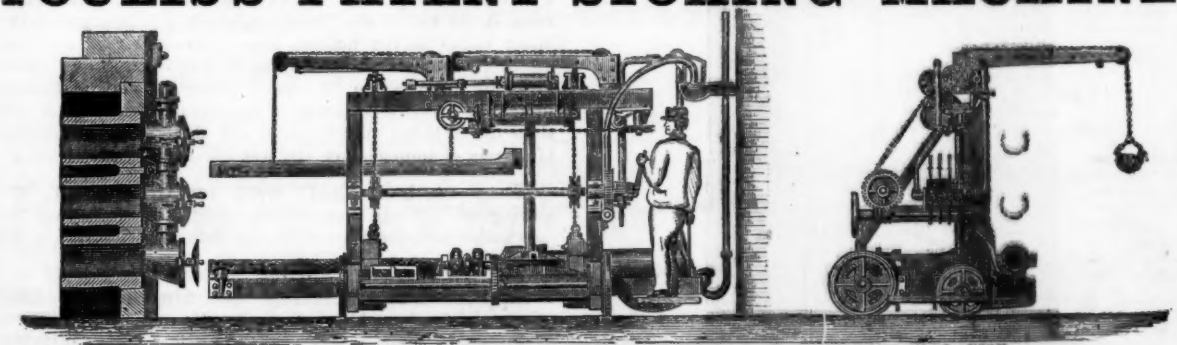
Drawings and Prices upon application.

FOULIS'S PATENT STOKING MACHINE.



SIDE ELEVATION OF CHARGING MACHINE. END ELEVATION

(The Drawing Machine will be Illustrated in next week's Advertisement.)

Makers: TANGYE BROTHERS and HOLMAN, London and Birmingham; ADAM WOODWARD and SON, Manchester; ROBERT LAIDLAW and SON, Glasgow; MASCHINENBAU-ACTIEN-GESELLSCHAFT HUMBOLDT, Kalk bei Deutz;

Or all particulars may be had from JAMES WOTHERSPOON, 31, St. Vincent Place, Glasgow.

C. & W. WALKER,
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MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the im- portant results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, re- quiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

F. & C. OSLER,

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MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

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PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,

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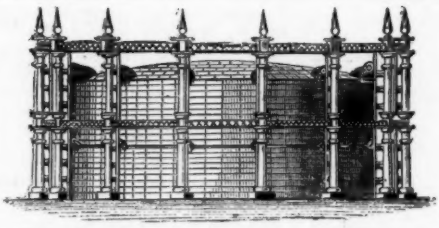

STOCKTON ON TEES.

ASHMORE & WHILE,

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MANUFACTURERS OF GASHOLDERS,

GAS APPARATUS OF EVERY DESCRIPTION,

Including Improved

Retort-Lids, Boilers, Cast and Wrought Iron Tanks, Iron Roofing, Bridges, Girders,

And GENERAL IRONWORK.

N.B.—Estimates for all Gas Plant and Remodelling supplied on application.

LESMAHAGOW CANNEL COAL.

FERRAND DAVIES,

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SOLE AGENT FOR

THOMAS BARR'S LESMAHAGOW MAIN CANNEL.

Quotation and Analysis forwarded on application.

NOTICE OF REMOVAL.

G. J. EVESON,

GAS COAL AND CANNEL CONTRACTOR,

Begs to intimate to his numerous connexion that, for the convenience of Gas Managers and others waiting upon him, he has removed from

89, HIGH STREET, STOURBRIDGE,

and that in future his HEAD OFFICES will be

123, NEW STREET, BIRMINGHAM,

Where all communications and inquiries should be addressed.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

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SHOTT'S BOGHEAD.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full Analyses on application.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

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The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,

CANNEL COAL MERCHANT,

HAYMARKET, EDINBURGH.

Established 1840.

HEBBURN MAIN GAS COALS.

T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,524 cubic feet per ton of 14½-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9866 cubic feet per ton of Coal carbonized were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

PRICES ON APPLICATION, EITHER F.O.B. OR BY RAIL IN TRUCK LOADS.

THE TYNE COAL COMPANY, LIMITED, OWNERS.
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ADDISON POTTER,

WILLINGTON QUAY,
NEAR NEWCASTLE-UPON-TYNE,
Manufacturer of

CLAY RETORTS, FIRE-BRICKS, AND EVERY DESCRIPTION OF FIRE-CLAY GOODS

TO GAS COMPANIES.

GEORGE McKAIG,

MANUFACTURER OF

GAS-PURIFYING WOOD SIEVES,

153, CLEVELAND STREET,

DONCASTER.

It requires but one trial to prove the Superior Make, Strength, and Durability of these Sieves.

CARRIAGE PAID.

GRIRDROD'S PATENT

PORTABLE PIPE SCREWING MACHINE,

For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

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THE ORIGINAL

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NEAR LEEDS,

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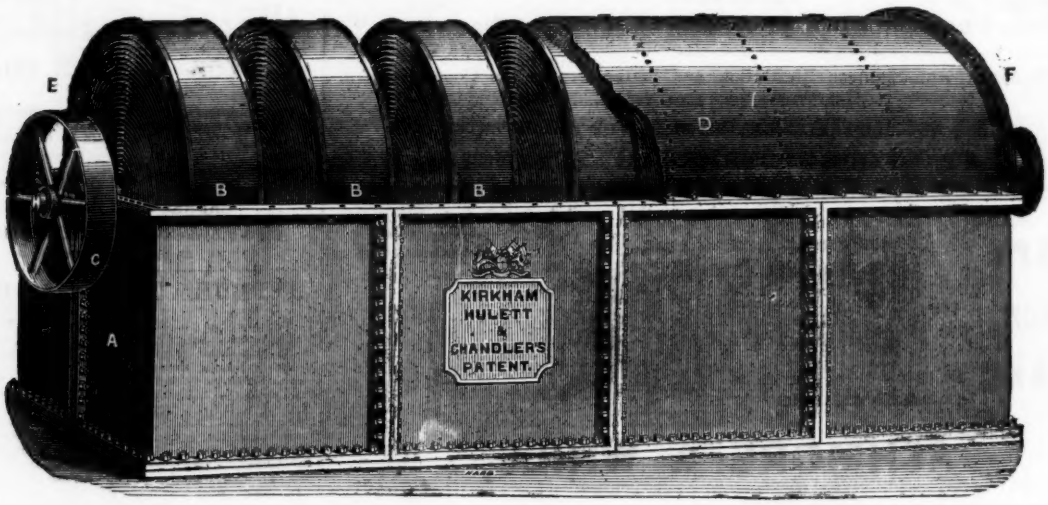
SPECIAL NOTICE.—Our Patent Machine-made Retorts have now been in *actual work* nearly 1000 days, and are yet in good order. References on application.

July 2, 1877.

STANDARD WASHER AND SCRUBBER.



The advantages of the Apparatus will doubtless be understood by those interested in gas manufacture.

The principal points of any Apparatus for the extraction of ammonia may be summarily stated as follows:—

1. **A large amount of Surface is desirable.**
2. **Such Surface should be always effectually Wetted.**
3. **The Surfaces or Scrubbing Material should cause no Pressure.**
4. **The Gas should meet various strength Liquors on its course.**
5. **However small the quantity of Water used, it ought to operate over the whole Surface.**
6. **Changing Scrubbing Material is both Objectionable and Expensive.**
7. **Economy both as to Space occupied and Cost of Apparatus is an important item.**

All these requisitions are supplied by the above Apparatus, of which the following is an explanation:—

A is a cast-iron tank, formed into several separate water-tight compartments.

B B B volutes of sheet iron fitted to the centre shaft, which is driven by the pulley, C, and causing the said volutes to revolve each in a separate compartment filled with water or other fluid.

D, the cover, has partitions fitted into it corresponding with those in the tank, sufficient space being left between the top of the partition in the tank and the lower edge of that in the cover, to allow the gas a free passage through the first volute to the second, and so on to the third, fourth, &c.

The action is as follows:—The crude gas entering at E is partly washed in the first compartment, which becomes 10 or 12 oz. liquor, or stronger if required, according to the quantity allowed to enter per ton; the gas then passes to the second, where the liquor is of a less strength; thence into a weaker liquor, as it passes from one compartment to the other, finishing at the last compartment or outlet, F, with clean water, which is constantly flowing and running over from one compartment to another, until it reaches the last space, from which it flows from the outlet-pipe into the well or tank ready for sale or removal.

Taps are inserted in each compartment for the convenience of drawing liquor for testing, &c.

Applications as to Cost, &c., may be obtained of either

Mr. D. HULETT, 55 & 56, HIGH HOLBORN;

Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER;

Or Messrs. CHANDLER, 104, NEWINGTON CAUSEWAY.

Inquirers will please state their Maximum Day Make.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

THE FARNLEY IRON COMPANY, LIMITED,

FARNLEY, near LEEDS,

MANUFACTURERS OF

FIRE-CLAY GAS-RETORTS & FIRE-BRICKS,

Of every size and shape, and of the best quality; also of White and Coloured GLAZED BRICKS, SANITARY PIPES, &c., &c.

In order to meet the constantly increasing demand for their Gas-Retorts, the F. I. Co. have recently made such an addition to their premises as will enable them to execute expeditiously the largest home or foreign orders.

London Agent for Gas-Retorts: D. W. OGG, 3, Jeffrey's Square, St. Mary's Axe, E.C.
,, ,, Glazed Bricks: A. BARFIELD, 22, Great George Street, Westminster.

IMPROVED
COMPENSATING GAS-METER.
HUNT'S PATENT.

This Meter supplies a want long felt, by putting an end to the loss sustained by Gas Companies through the overworking of their Meters.

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"I am able to report that the Meters have given in each test most satisfactory results."—*Mr. H. Sporne, City of London Meter Inspector.*
"I consider the arrangement is a great improvement upon the Meters in present general use."—*Mr. T. Jackson, Meter Inspector, Birmingham.*
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COPIES OF REPORTS SENT ON APPLICATION.

MANUFACTURED BY

JOHN BENT & SON,

WET AND DRY GAS-METER AND GAS APPARATUS MANUFACTURERS,

BELL BARN ROAD, BIRMINGHAM.

Established 1830.

NEWTON, CHAMBERS, & CO.,
THORNCLIFFE IRON-WORKS AND COLLIERIES,
NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.

A recent extensive development of the Collieries enables us to offer increased supplies.

JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—

"Warrington Gaslight and Coke Company,
Offices, Mersey Street, Warrington, April 23, 1877.

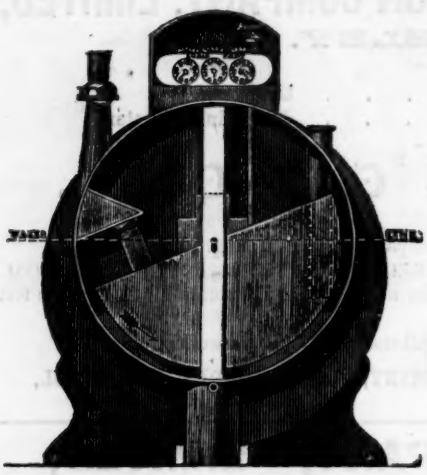
"MESSRS. NEWTON, CHAMBERS, AND CO.,

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

"The average of Nine samples gives a yield of **12,500** cubic feet of **15½**-Candle Gas, being equivalent to **664** lbs. of sperm per ton, and **1420** lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

"Yours truly, "JAMES PATERSON."

Full particulars will be sent on application to us—address as above.



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UNVARYING WATER-LINE GAS-METER.

(SANDERS AND DONOVAN'S PATENT.)

"Unquestionably the best Water Gas-Meter now in use."—Thos. G. Barlow, C.E.

Over 120,000 in action.

MANUFACTURERS:

THE GAS-METER COMPANY, LIMITED,

KINGSLAND ROAD, LONDON;

WITH

Branch Manufactories at DUBLIN and OLDHAM.

MR. A. VERNON HARCOURT'S COLOUR TESTS,

FOR BISULPHIDE OF CARBON, SULPHURETTED HYDROGEN, AND CARBONIC ACID IN COAL GAS.

The usual method by which the quantity of sulphur in coal gas is determined demands much time and considerable manipulative skill, as well as expensive apparatus. With Mr. Harcourt's Apparatus a test may be easily made by any intelligent person within a quarter of an hour, and the quantity of sulphur in any sample of gas ascertained within two or three grains per 100 cubic feet.

The Tests for Sulphuretted Hydrogen and for Carbonic Acid are equally simple.

THIS APPARATUS OUGHT TO BE POSSESSED BY EVERY GAS COMPANY.

Descriptive Particulars sent on receipt of 2d. in Stamps.

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THE UNVARYING WATER-LINE GAS-METERS,

IMPROVED DRY GAS-METERS, in Cast-Iron or Tin-Plate Cases;

STATION-METERS, ALL SIZES, up to 15 feet Square, with PLANED JOINTS;

Experimental Meters, Photometers, Pressure-Gauges,

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HYDRAULIC CRANES & HOISTS,

Effecting an IMMENSE SAVING in the cost of discharging Coals from Vessels, Barges, &c.

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